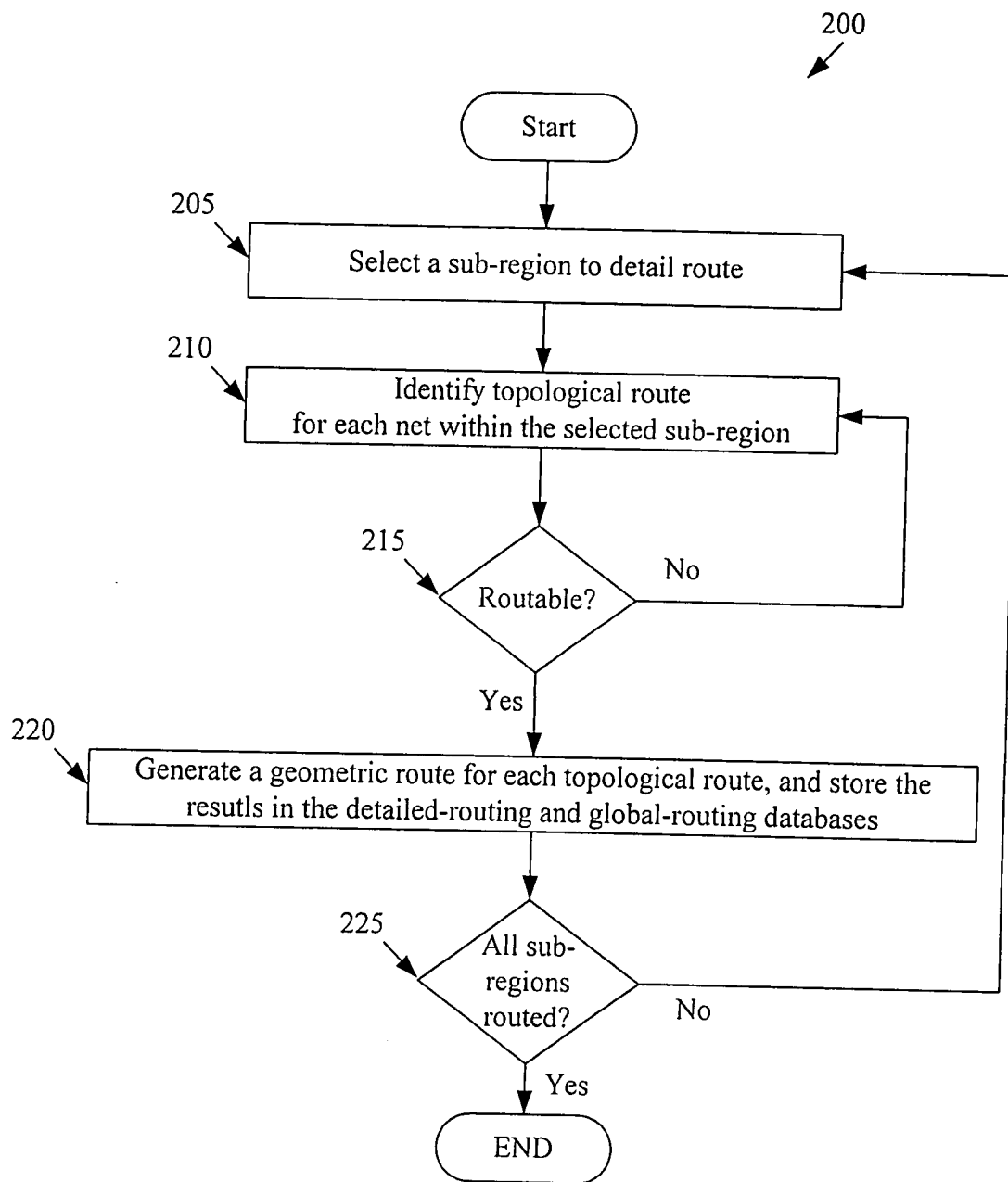
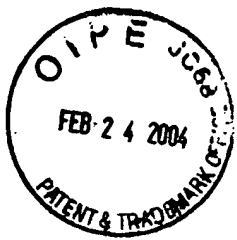
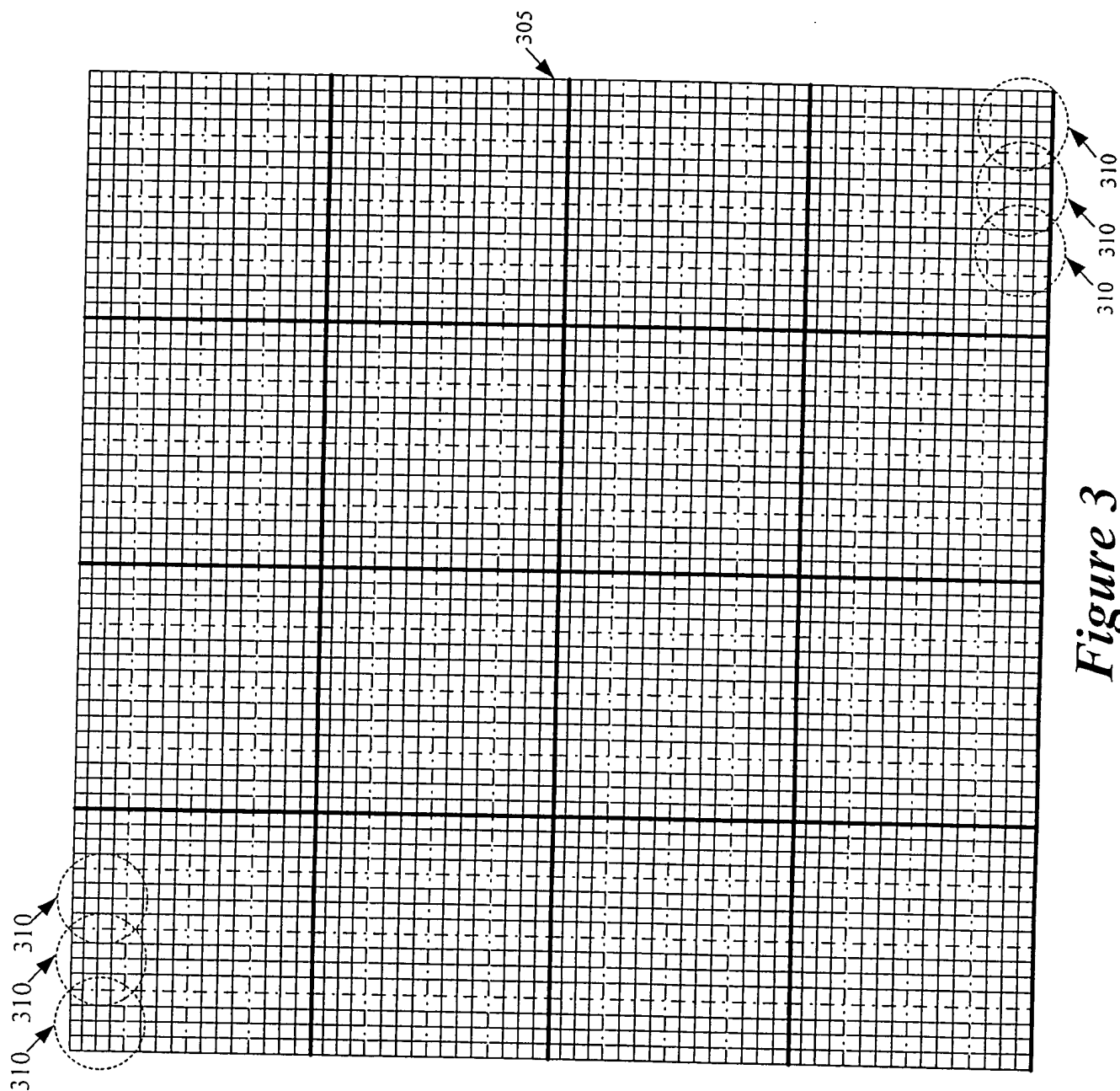


*Figure 1*



**Figure 2**



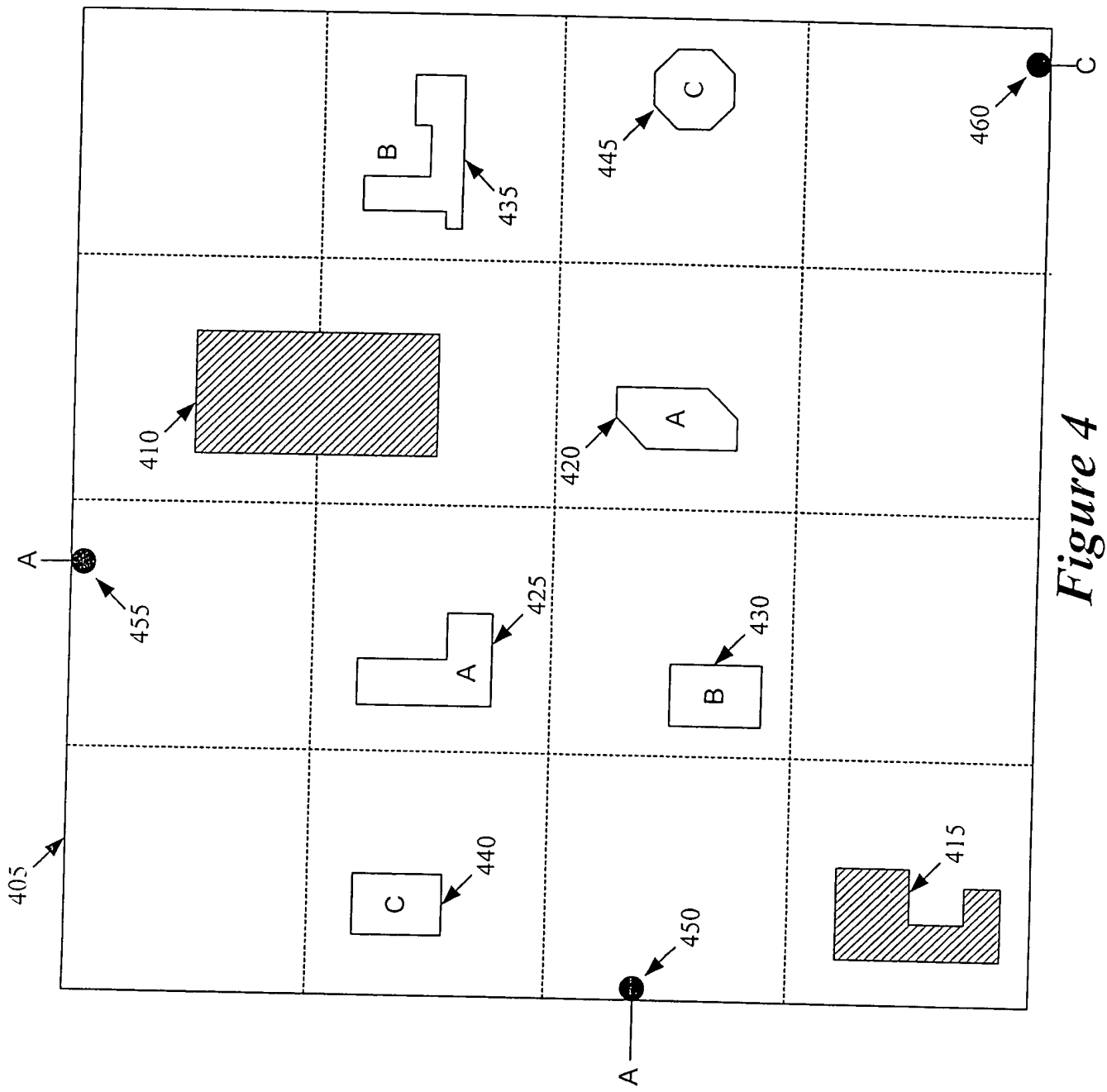
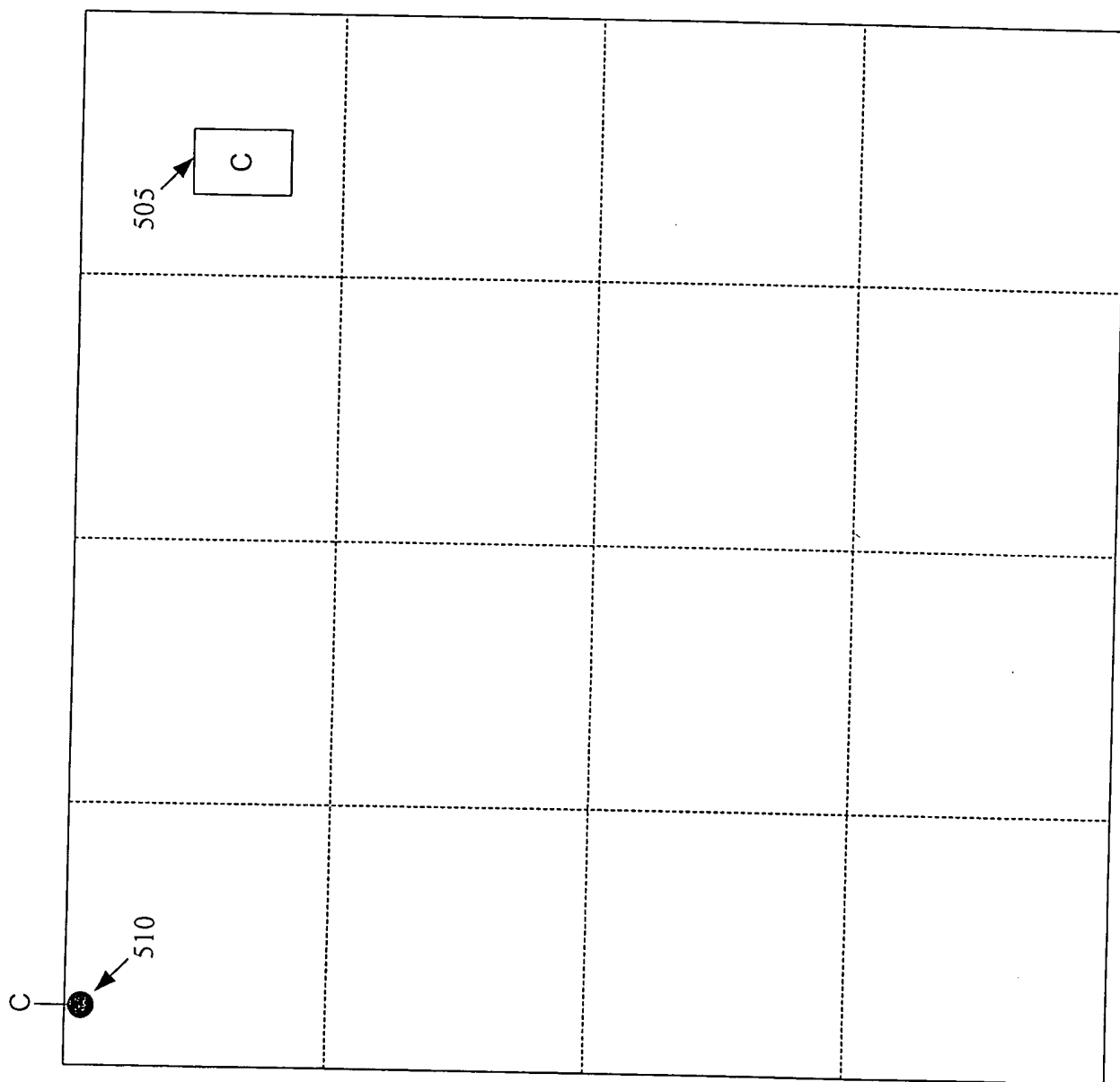
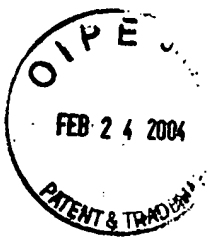


Figure 4



*Figure 5*

*Figure 6*

- List of Geometries
  - Each Geometry including a sequence of points & layer assignment
- Bounding box of the region
- Array of layer properties
  - Minimum wire size
  - Minimum spacing
  - Via sizes
  - Cost/Unit
- Netlist specifying a number of nets
  - Each net specifying a set of pins
    - Each pin specifying a set of ports
    - Each port specifying a set of geometries

*Figure 7*

- List of Geometries
  - Each Geometry including a sequence of points & layer assignment
    - List of connection nodes inside each pin geometry
- Bounding box of the region
- Array of layer properties
  - Minimum wire size
  - Minimum spacing
  - Via sizes
  - Cost/Unit
- Netlist specifying a number of nets
  - Each net specifying a set of pins
    - Each pin specifying a set of ports
    - Each port specifying a set of geometries
- For each layer, a graph specifying
  - Nodes
  - Edges
  - Faces



Face
<ul style="list-style-type: none"><li>-Reference to 3 edges</li><li>-Reference to 3 nodes</li><li>-Up to two references for up to two face item</li></ul>

800

Edge
<ul style="list-style-type: none"><li>-Two references for up to two faces of the edge</li><li>-Capacity</li><li>-Flow</li><li>-Constrained</li><li>-Linked list of items on the edge starting with one of the edge's nodes and ending with its other node</li></ul>

900

Figure 8

Figure 9

Node
<div>1000</div> <ul style="list-style-type: none"><li>-Net Identifier</li><li>-One or more planar-path references to adjacent topological items in the same planar path</li><li>-A pair of via-path references to up and down topological via items</li><li>-A references to list of edges connected to the node</li><li>-For each edge, an edge reference to the next or previous topological item on the edge</li><li>-A reference to the geometry of the node</li><li>-Vertex number identifying the vertex of the geometry</li><li>-Location of the node</li></ul>

Figure 10

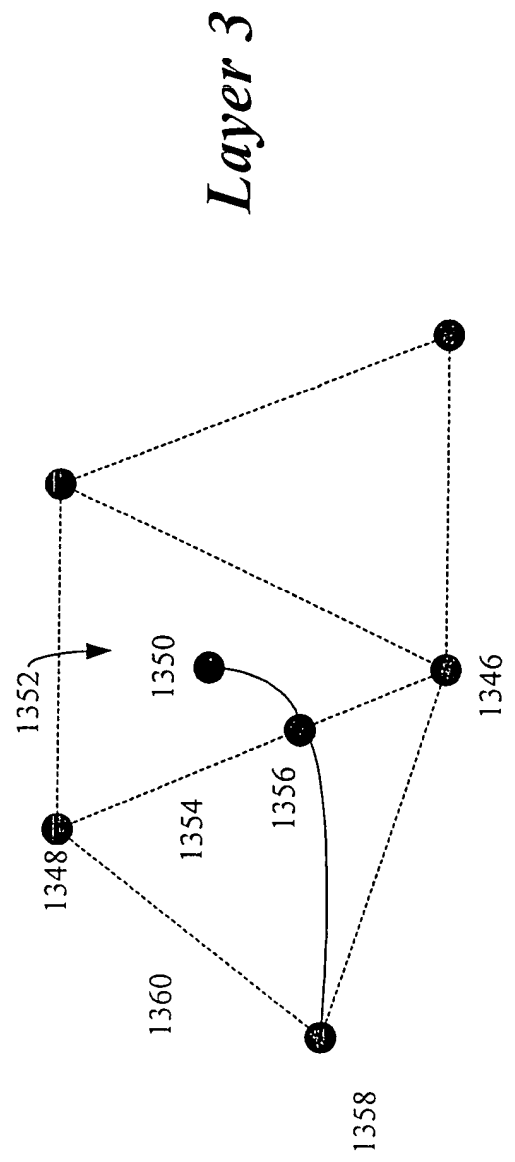
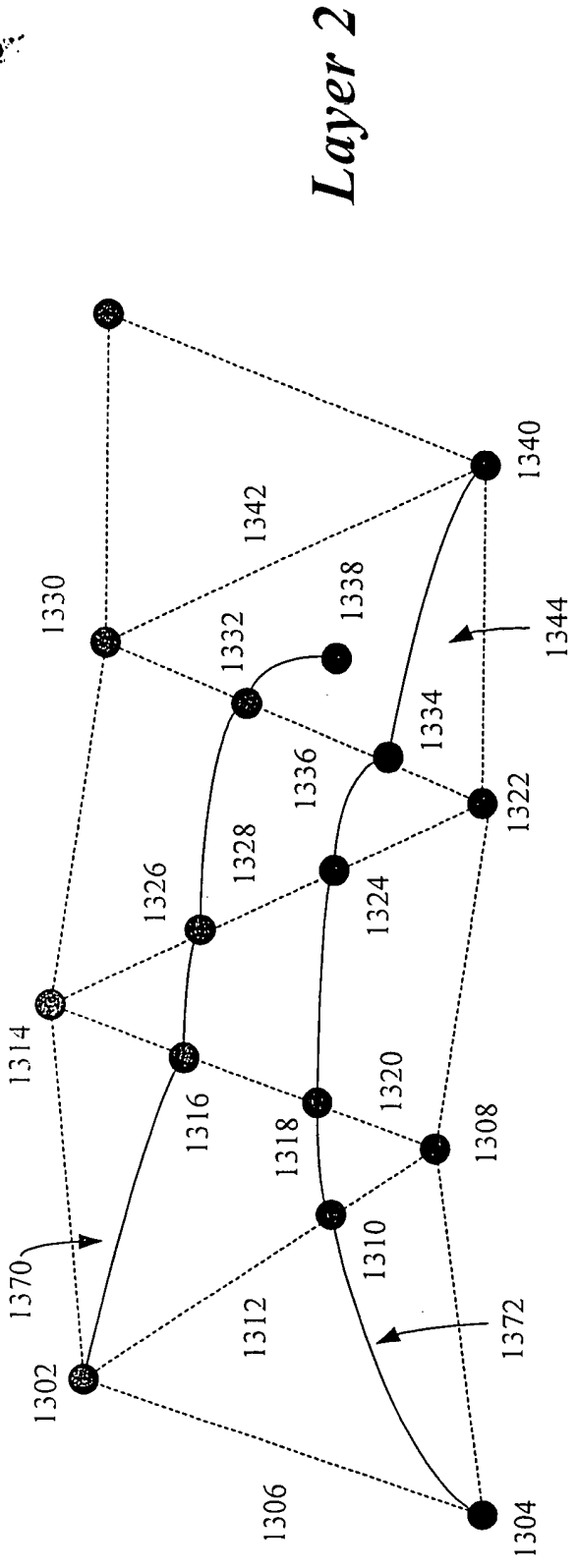
Edge Item
<div>1100</div> <ul style="list-style-type: none"><li>-Reference to its edge</li><li>-Net Identifier</li><li>-A pair of planar-path references to adjacent topological items in the same planar path</li><li>-A pair of edge references to the next and previous topological item on the edge</li></ul>

Figure 11

Face Item
<div>1200</div> <ul style="list-style-type: none"><li>-Reference to its face</li><li>-Net Identifier</li><li>-Up to 3 planar-path references for adjacent topological items in the same planar path</li><li>-A pair of via-path references for up and down topological via items</li><li>-Bounding polygon that defines legal face item locations</li><li>-Constraining Points and Distances</li></ul>

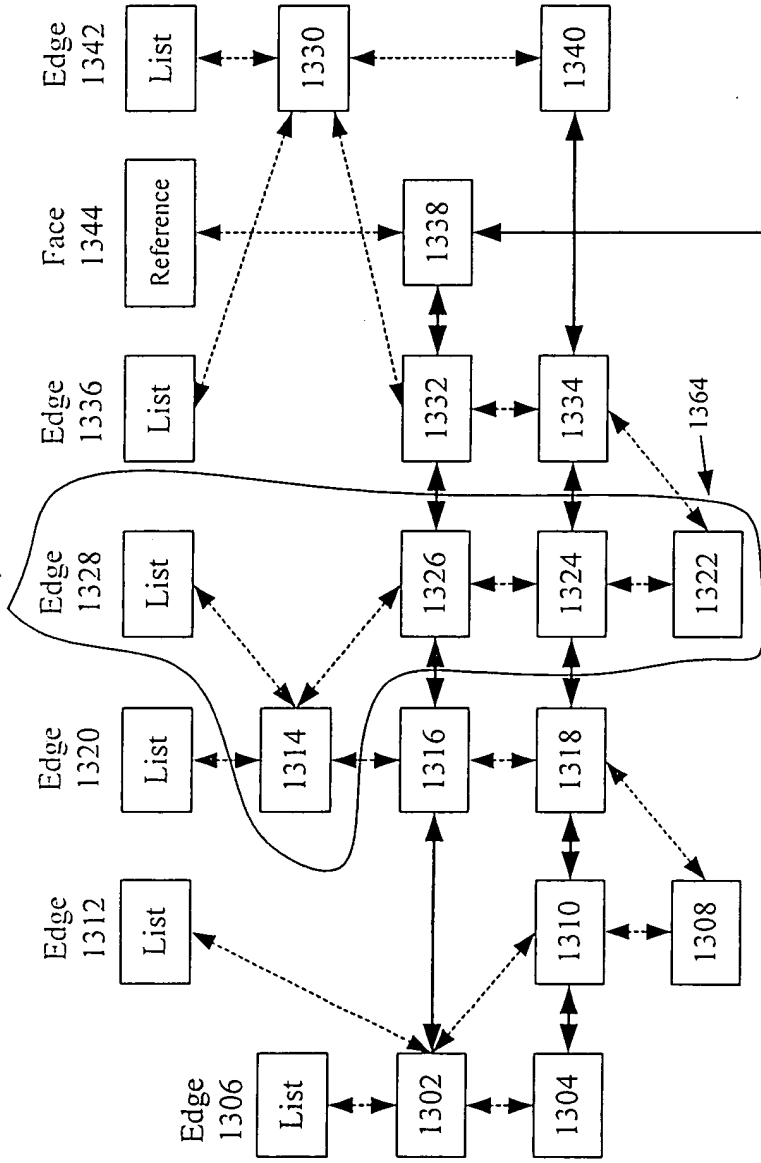
Figure 12





*Figure 13*

## Layer 2



## Layer 3

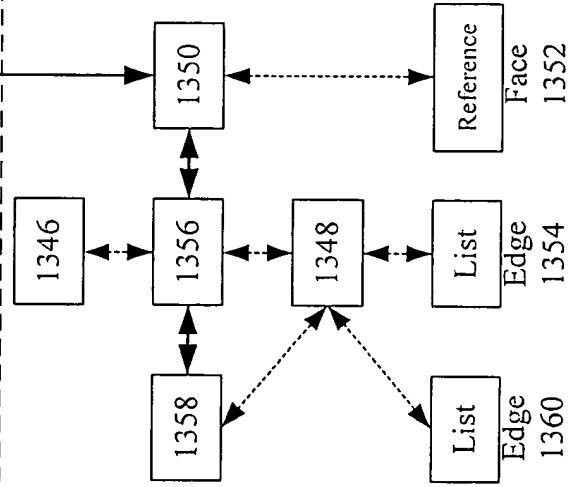
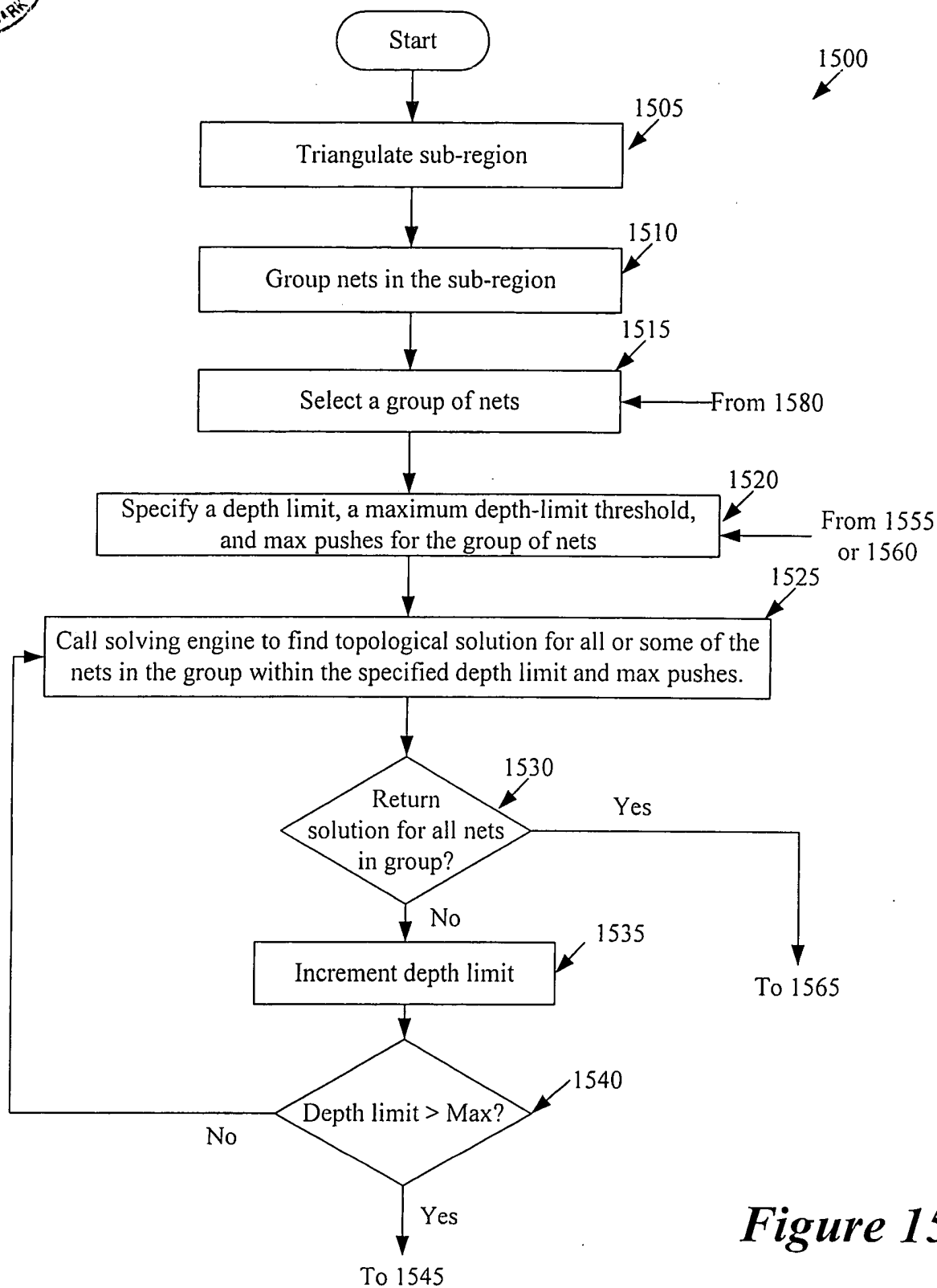
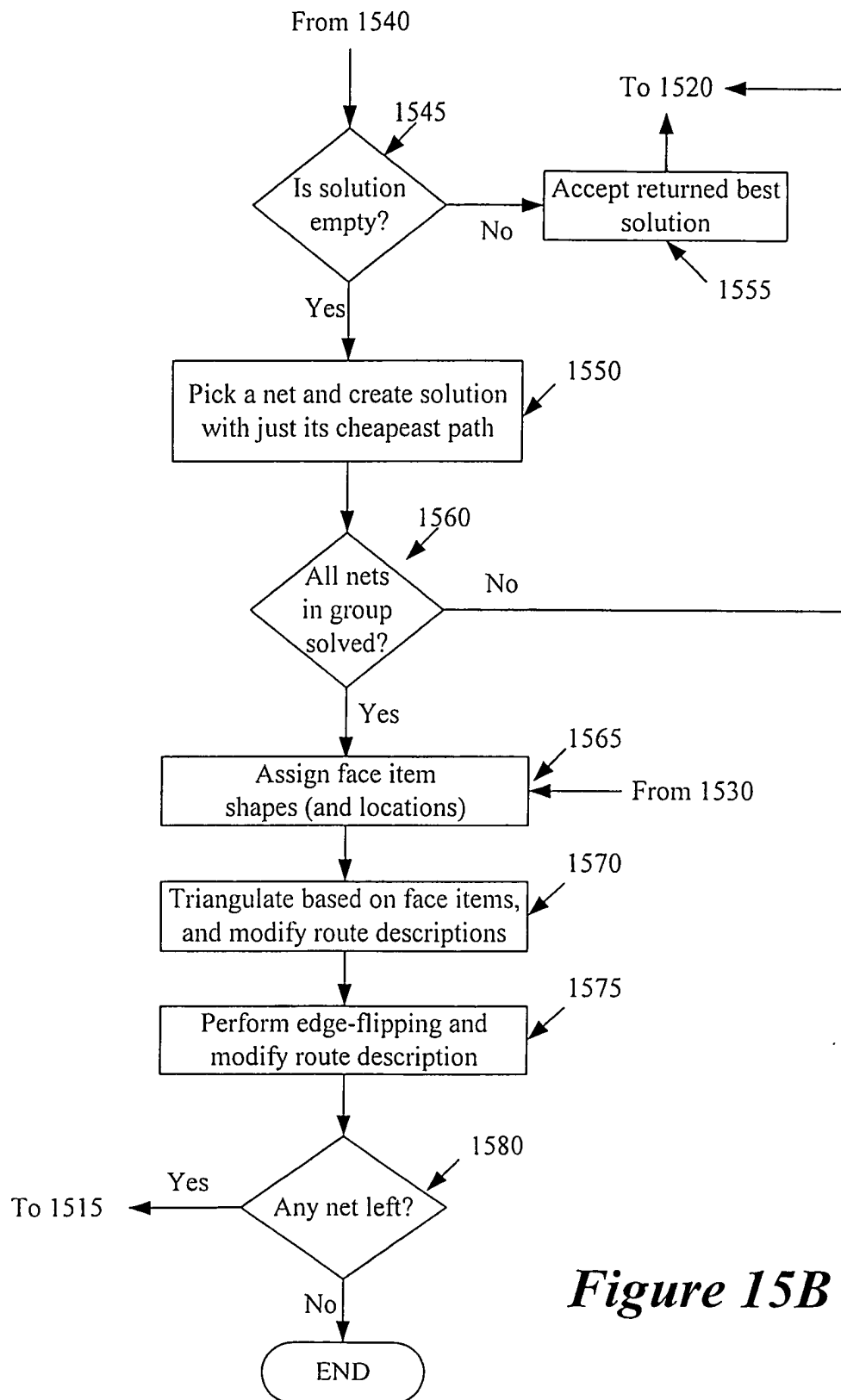


Figure 14

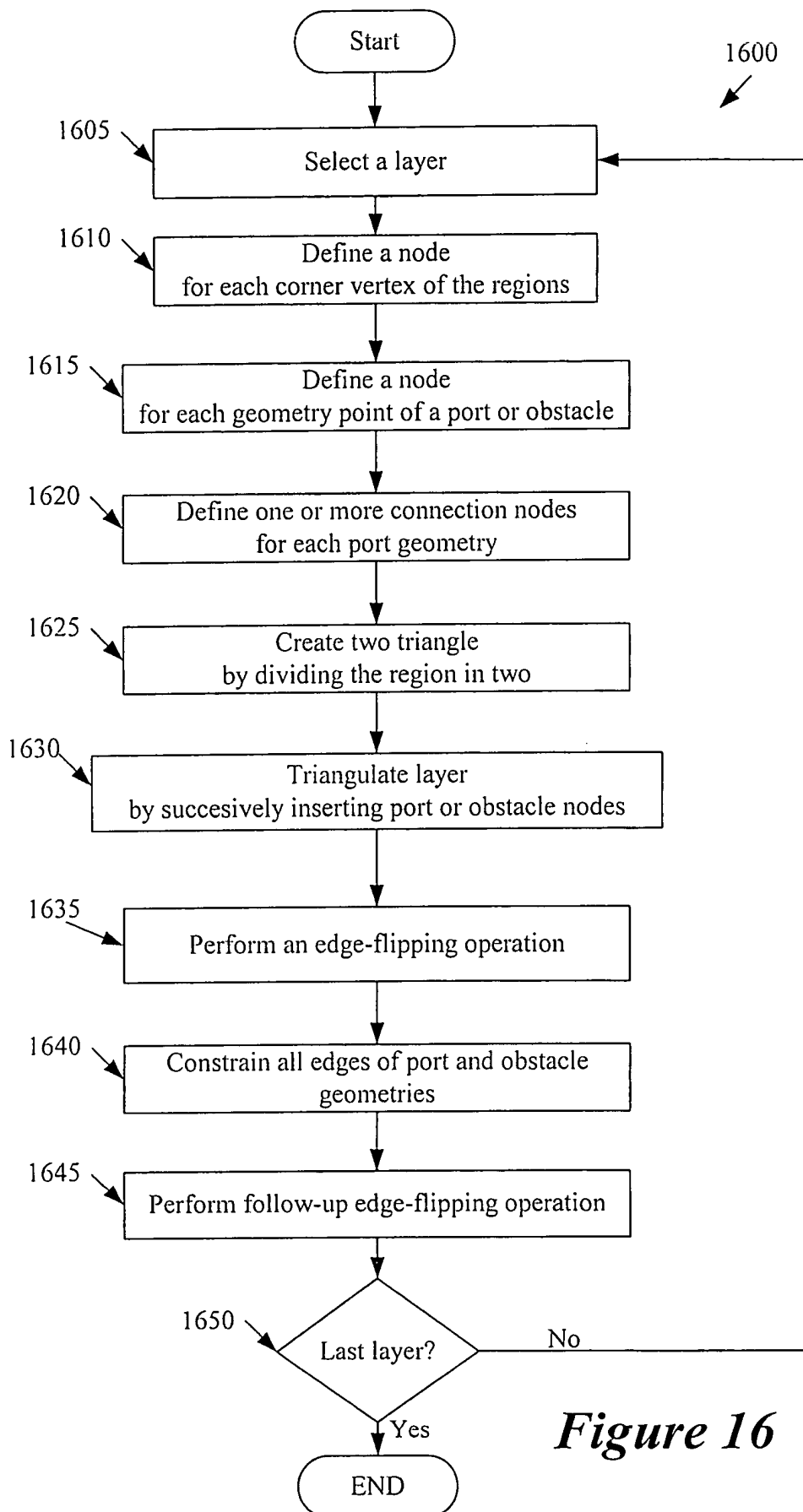


*Figure 15A*

*Figure 15: Figure 15A  
Figure 15B*



**Figure 15B**



*Figure 16*

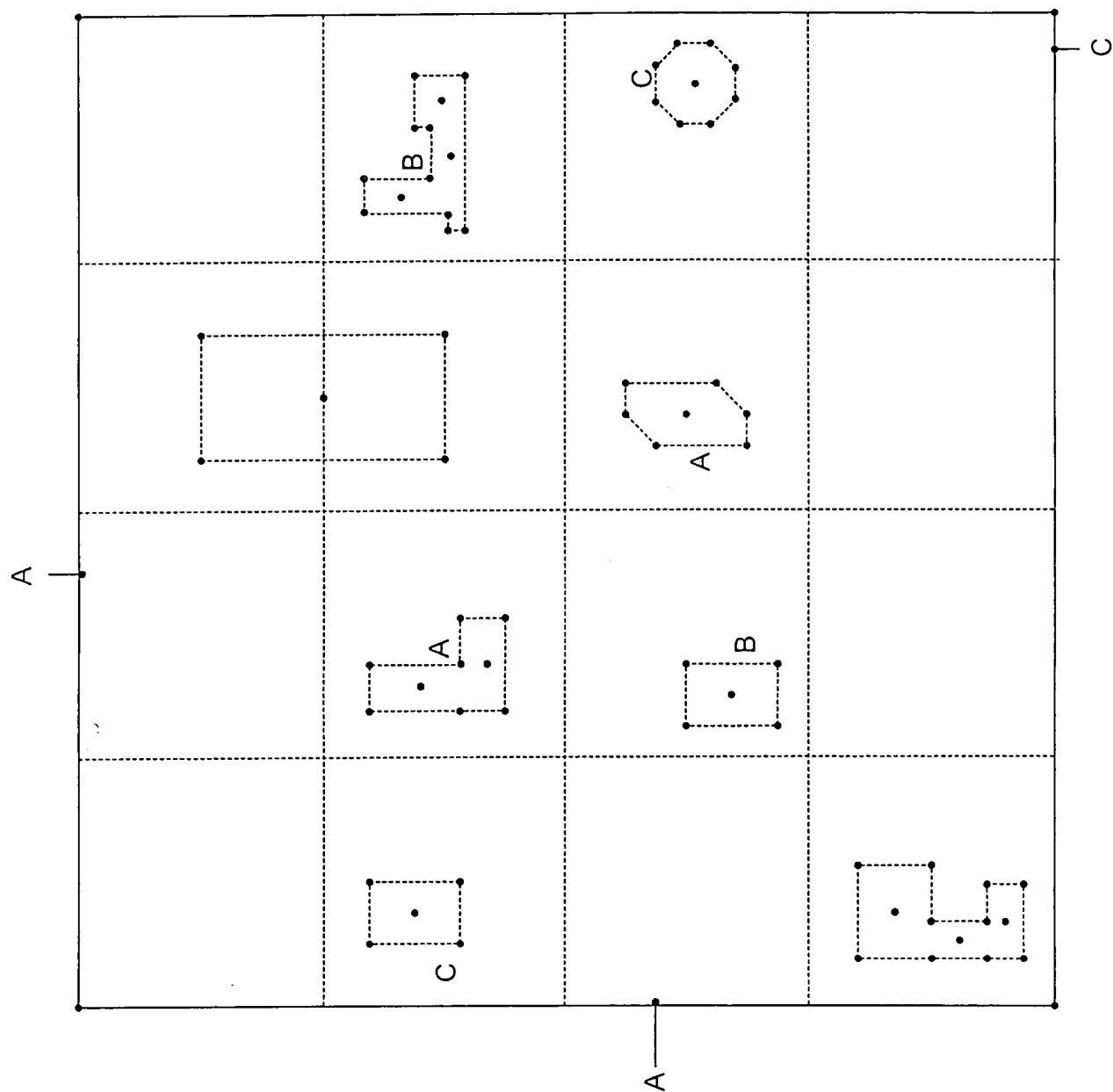
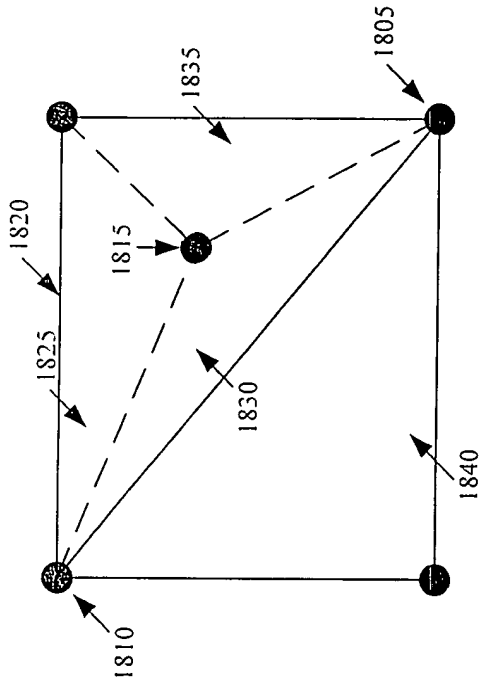
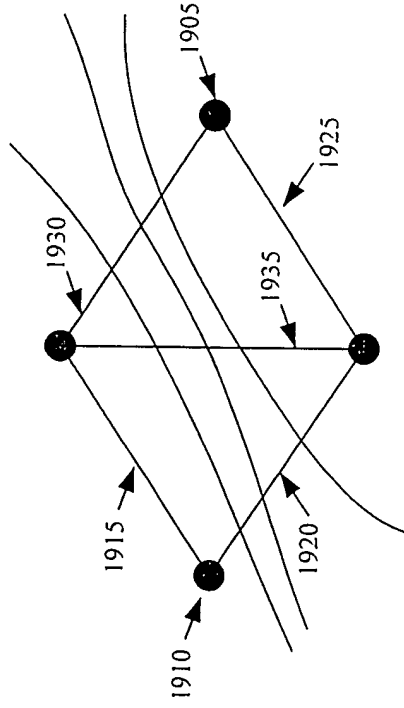


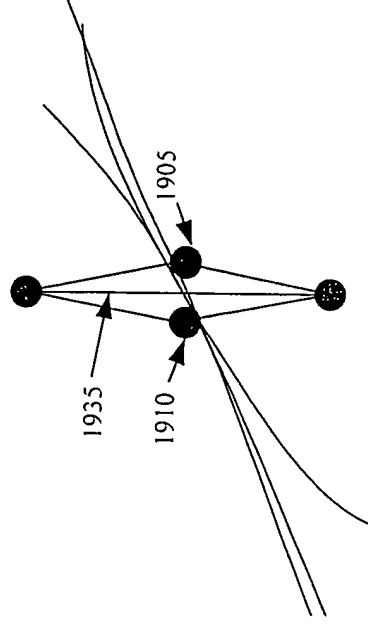
Figure 17



*Figure 18*



*Figure 19*



*Figure 20*

Figure 21

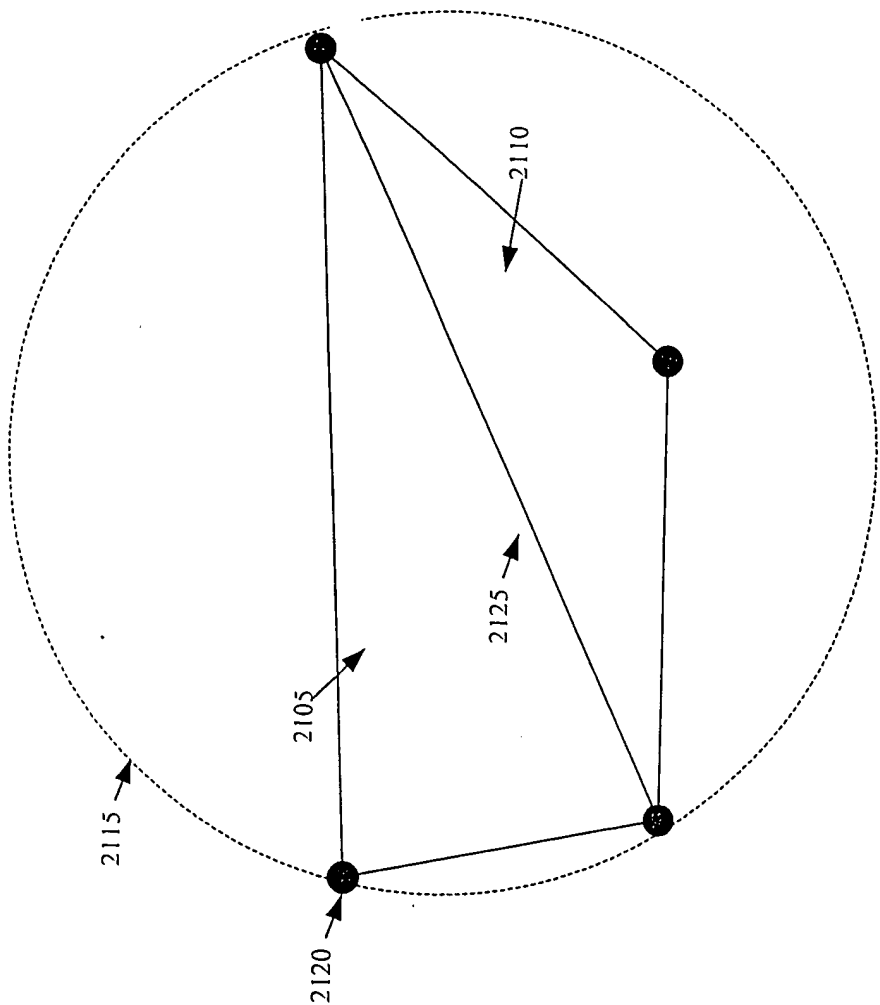
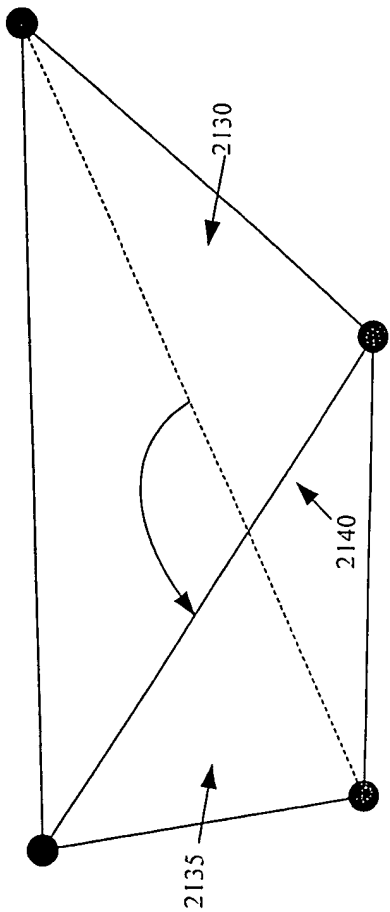


Figure 22





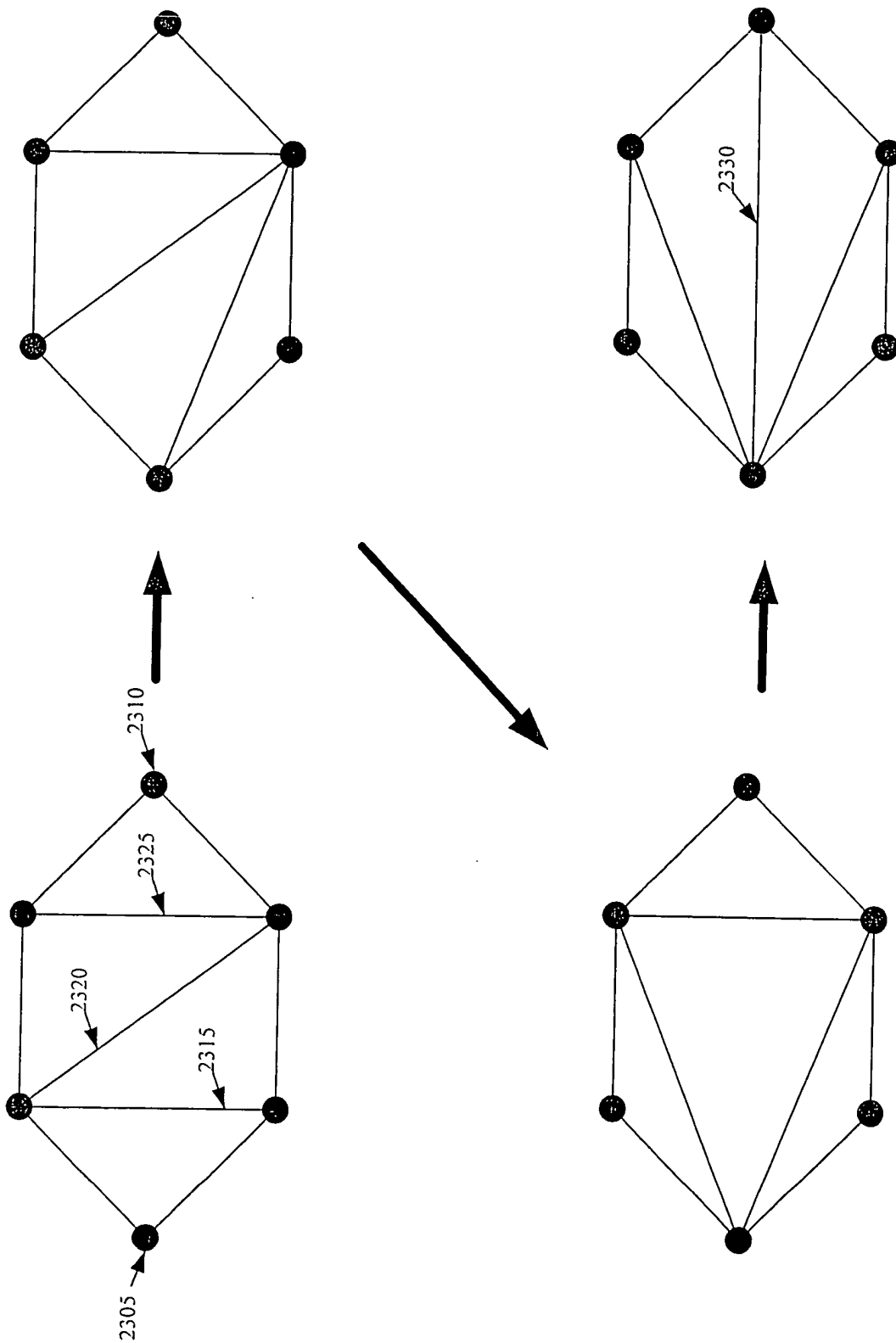


Figure 23

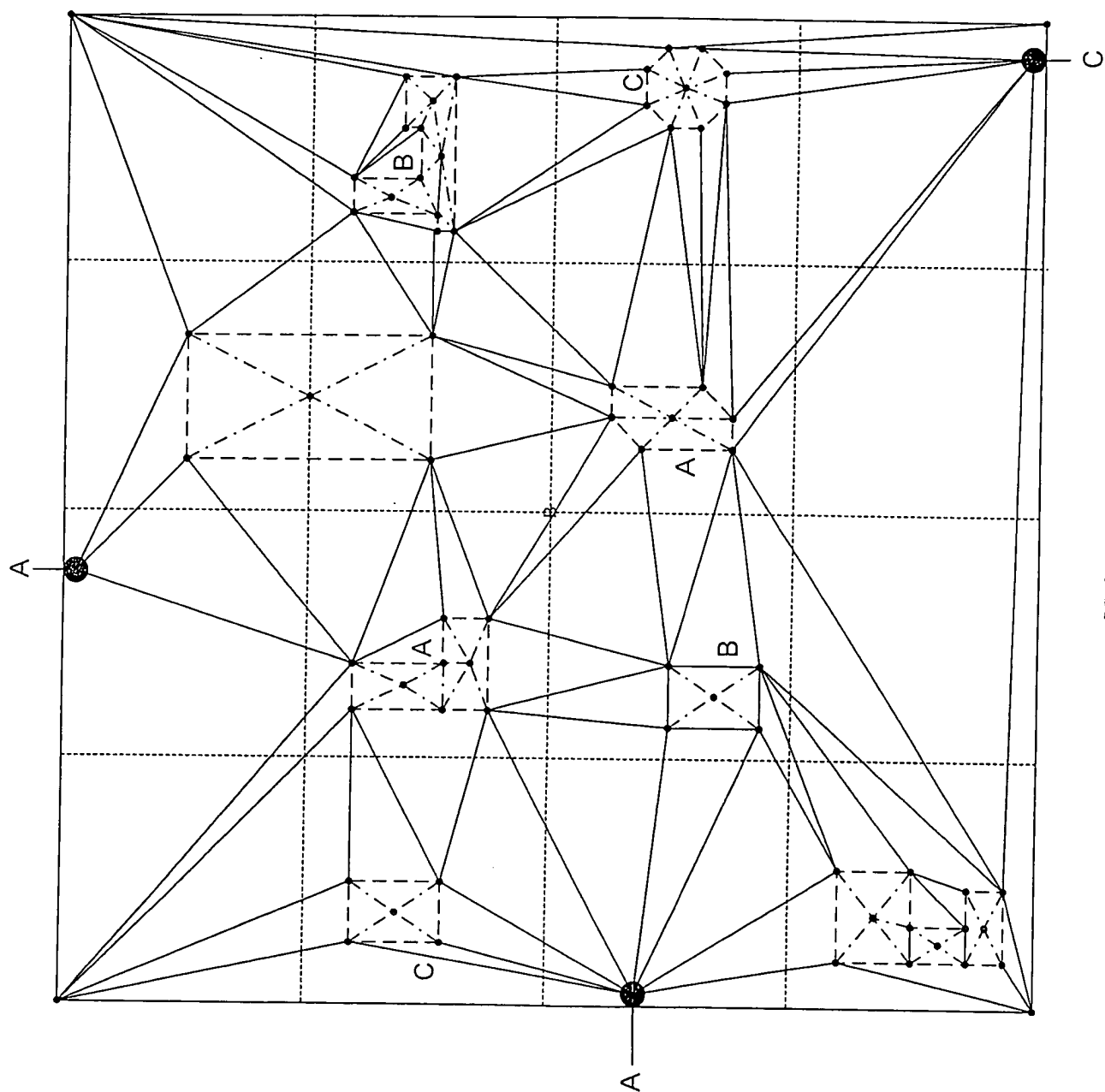
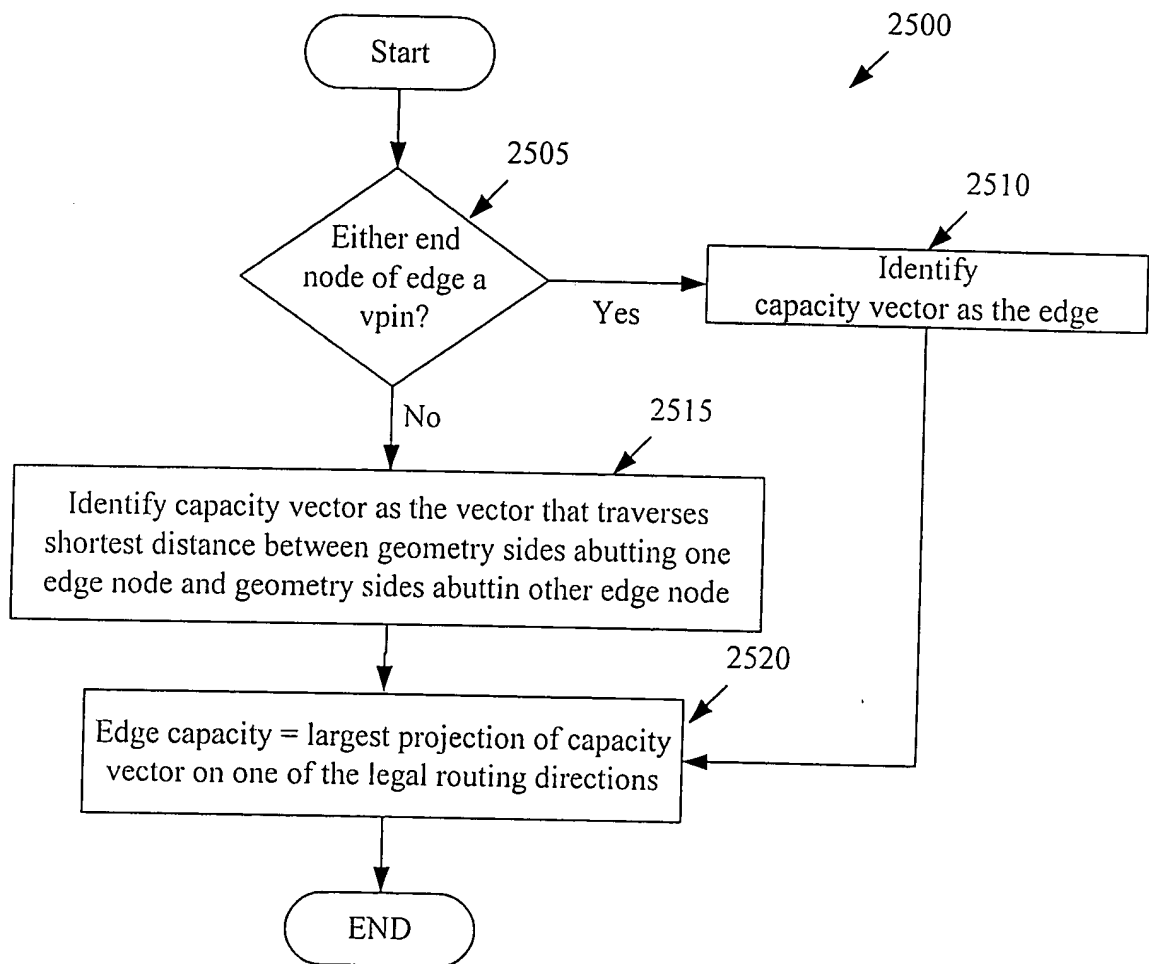
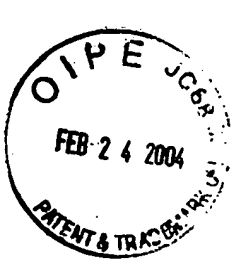
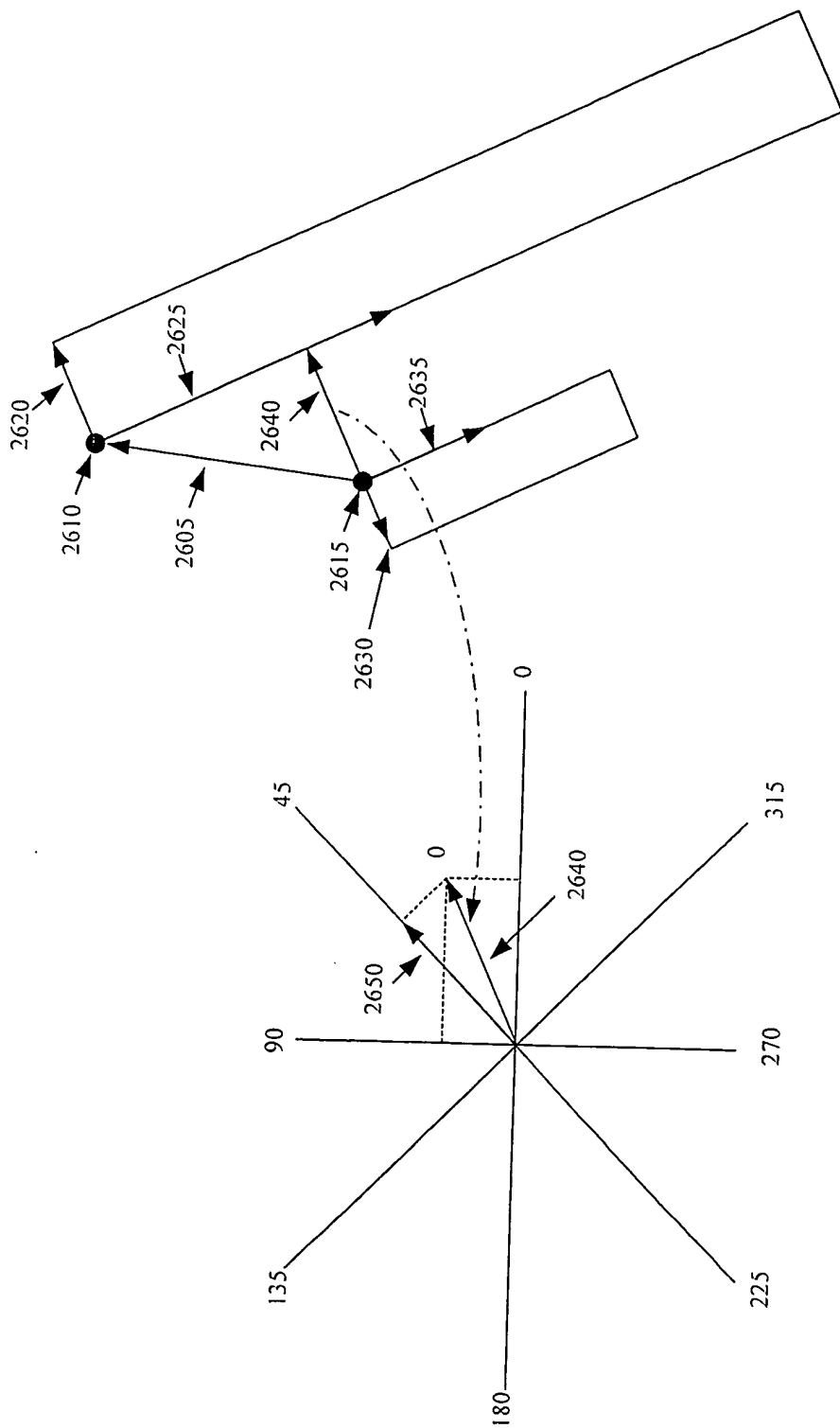


Figure 24



*Figure 25*



*Figure 26*

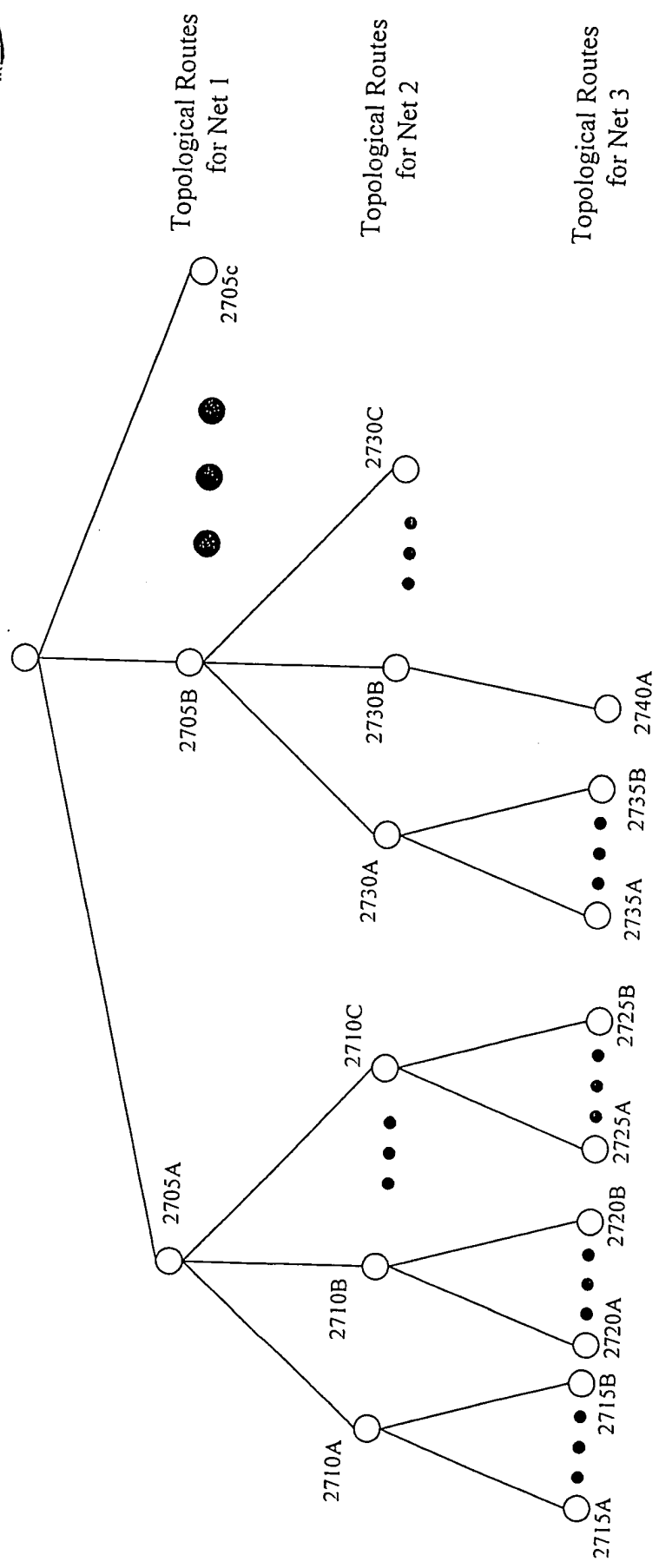
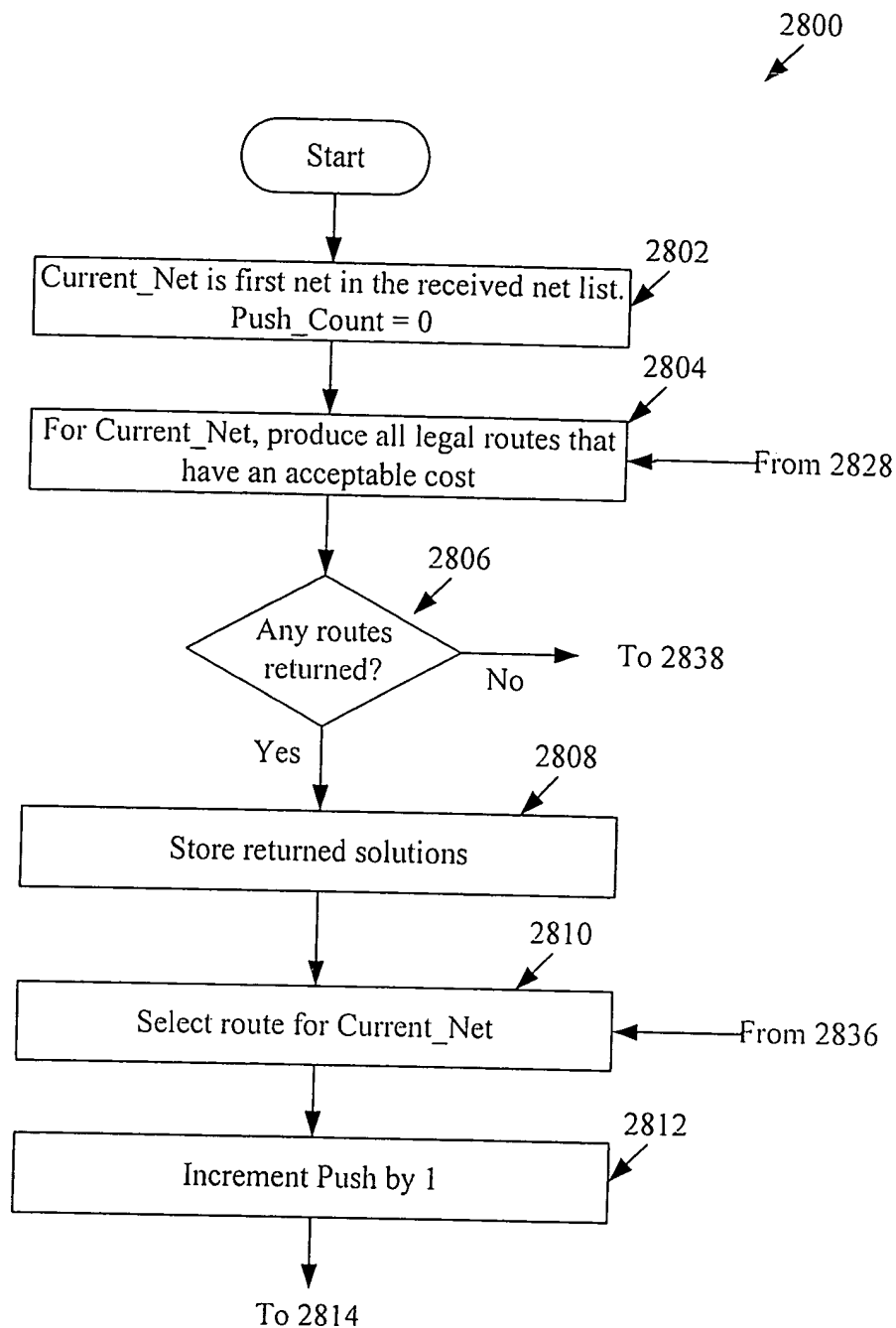
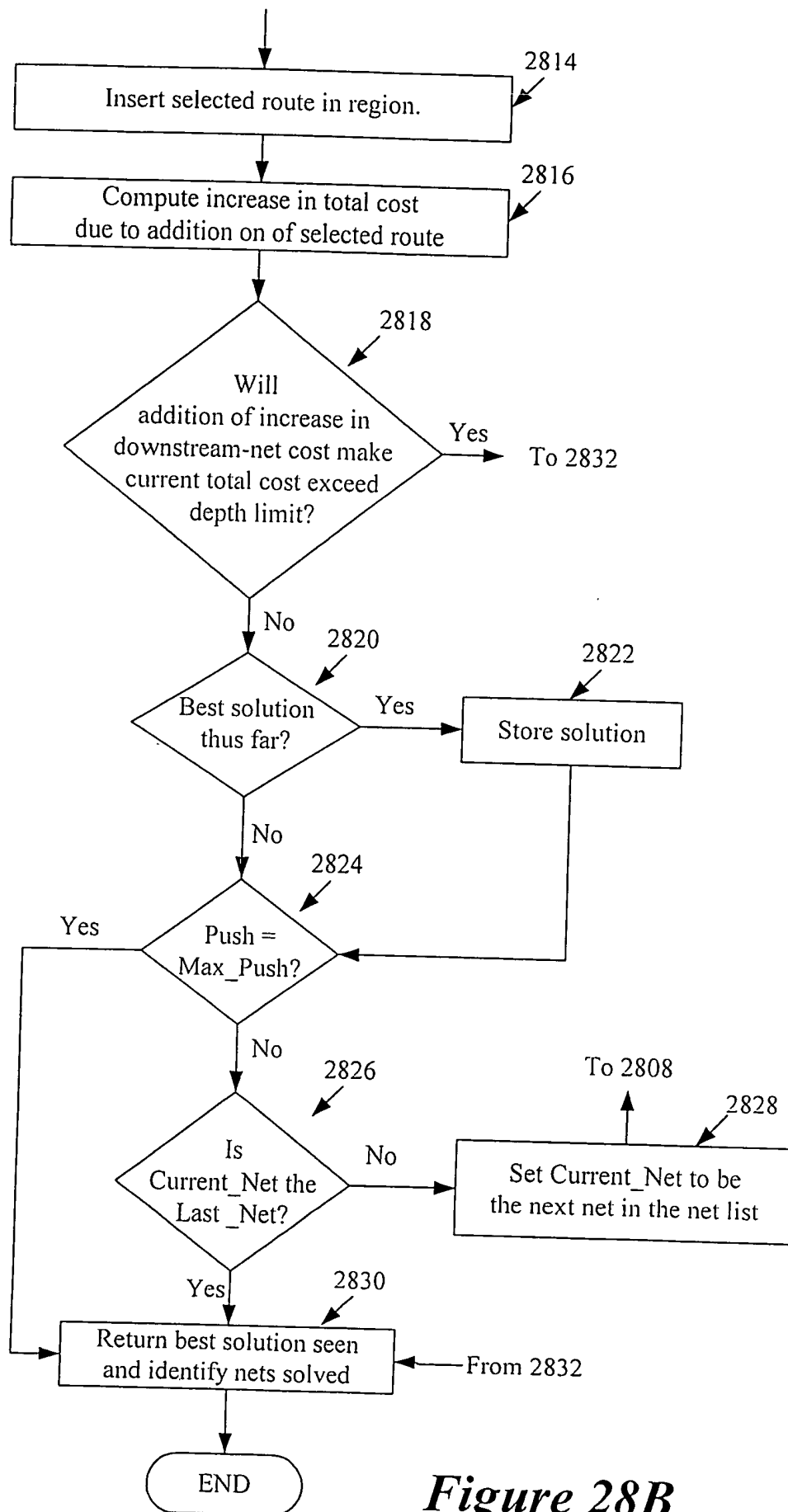


Figure 27

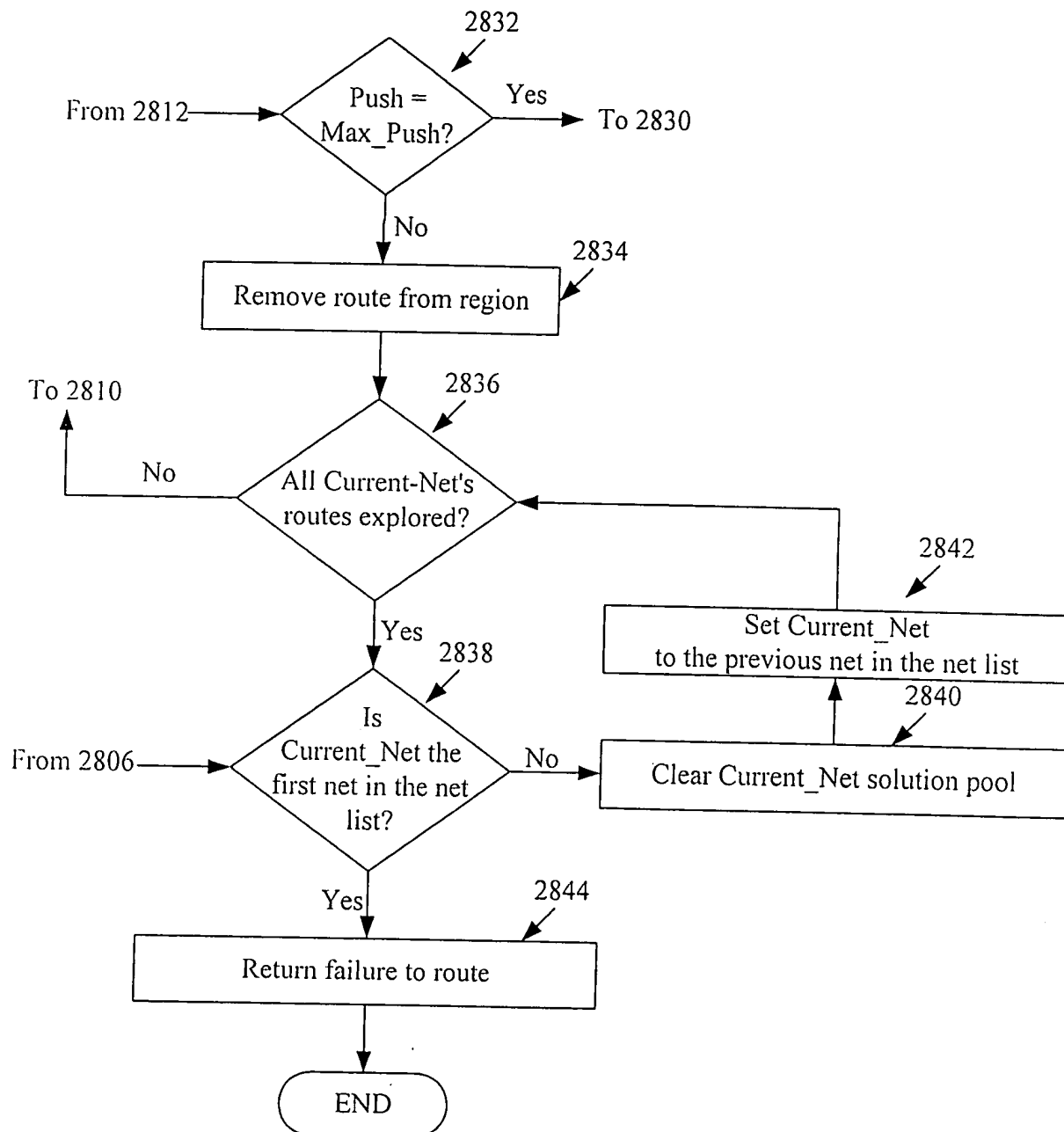


*Figure 28A*

*Figure 28:*  $\frac{\text{Figure 28A}}{\frac{\text{Figure 28B}}{\text{Figure 28C}}}$

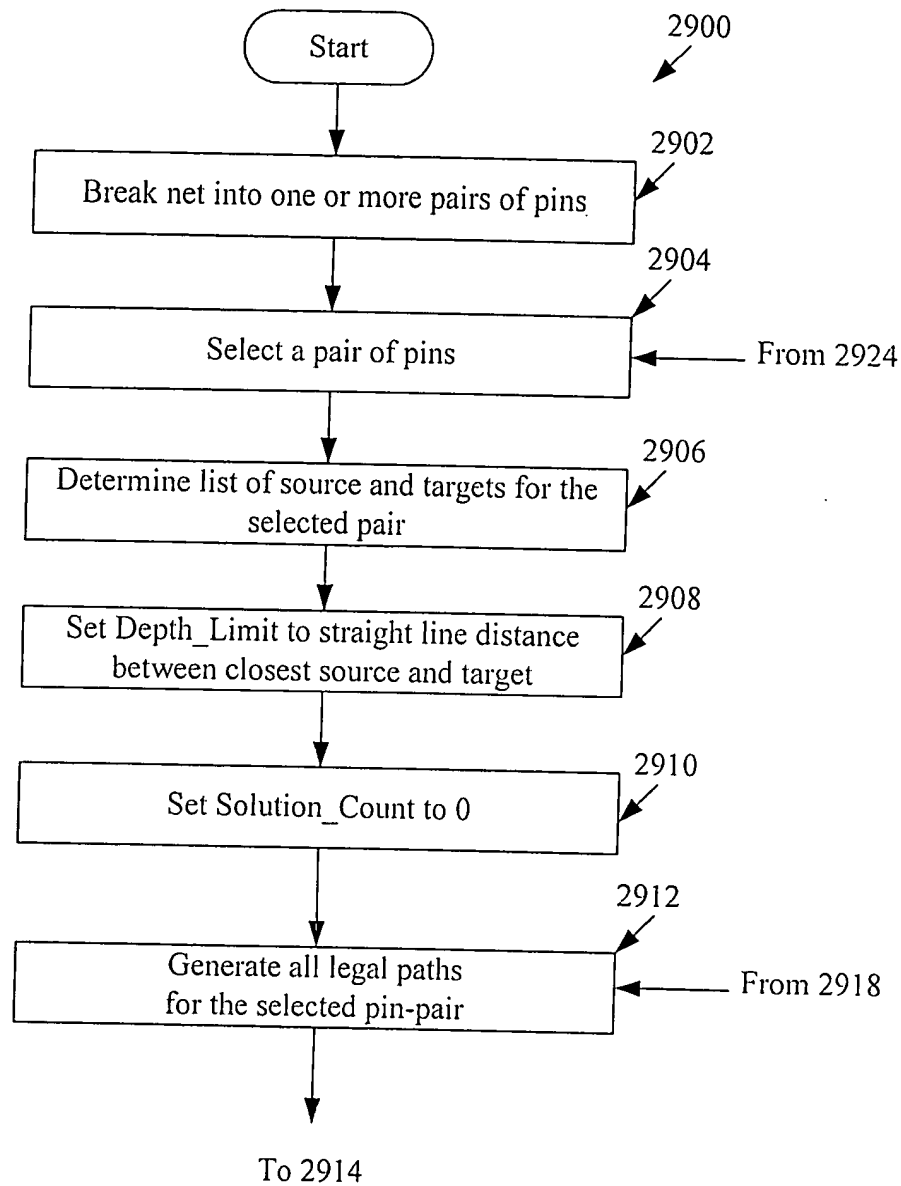
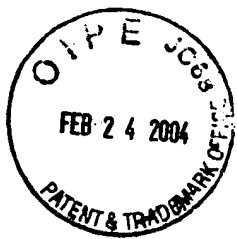


**Figure 28B**



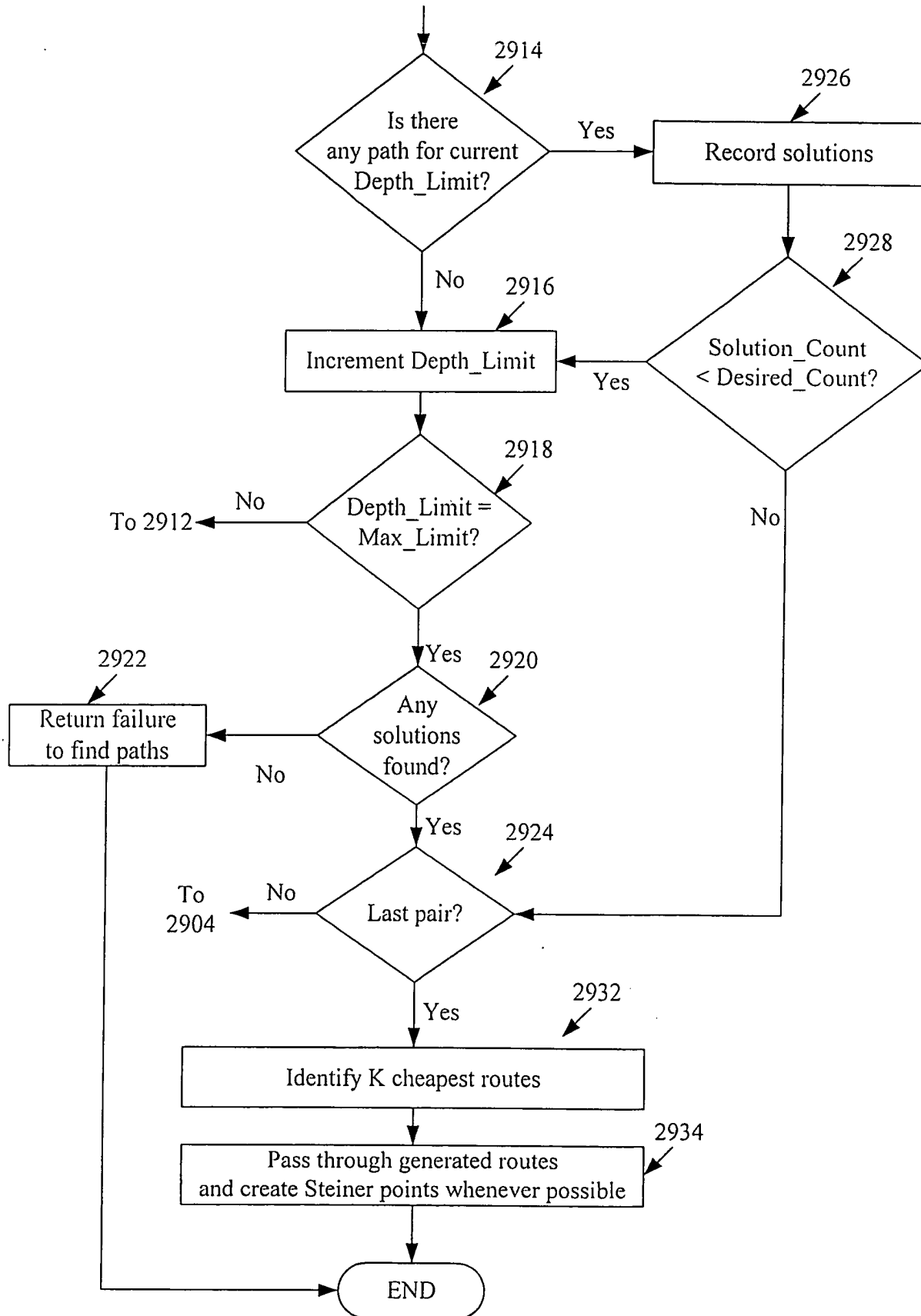
*Figure 28C*





*Figure 29A*

*Figure 29:*  $\frac{\text{Figure 29A}}{\text{Figure 29B}}$



**Figure 29B**

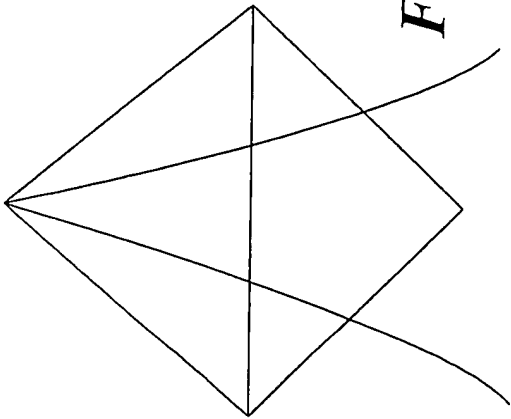


Figure 30A

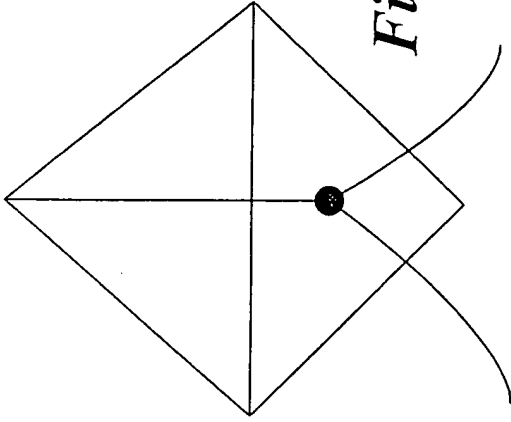


Figure 30B

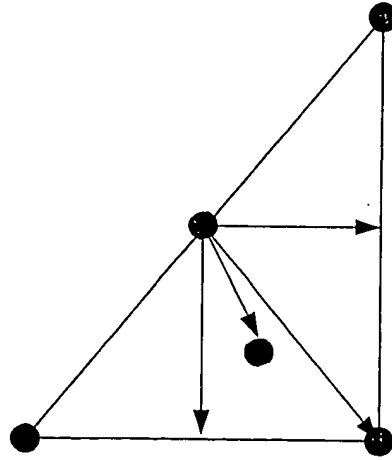


Figure 32

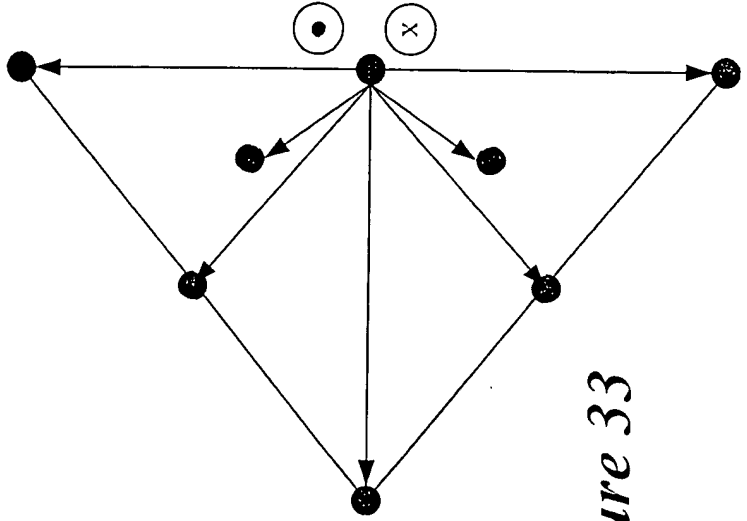


Figure 33

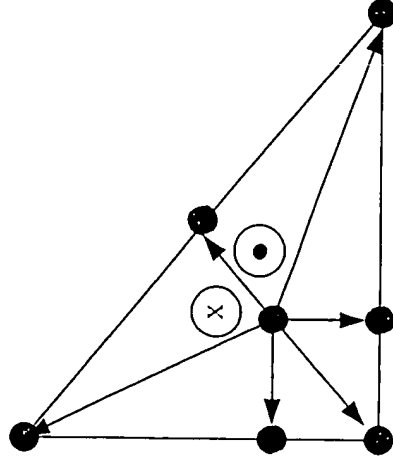
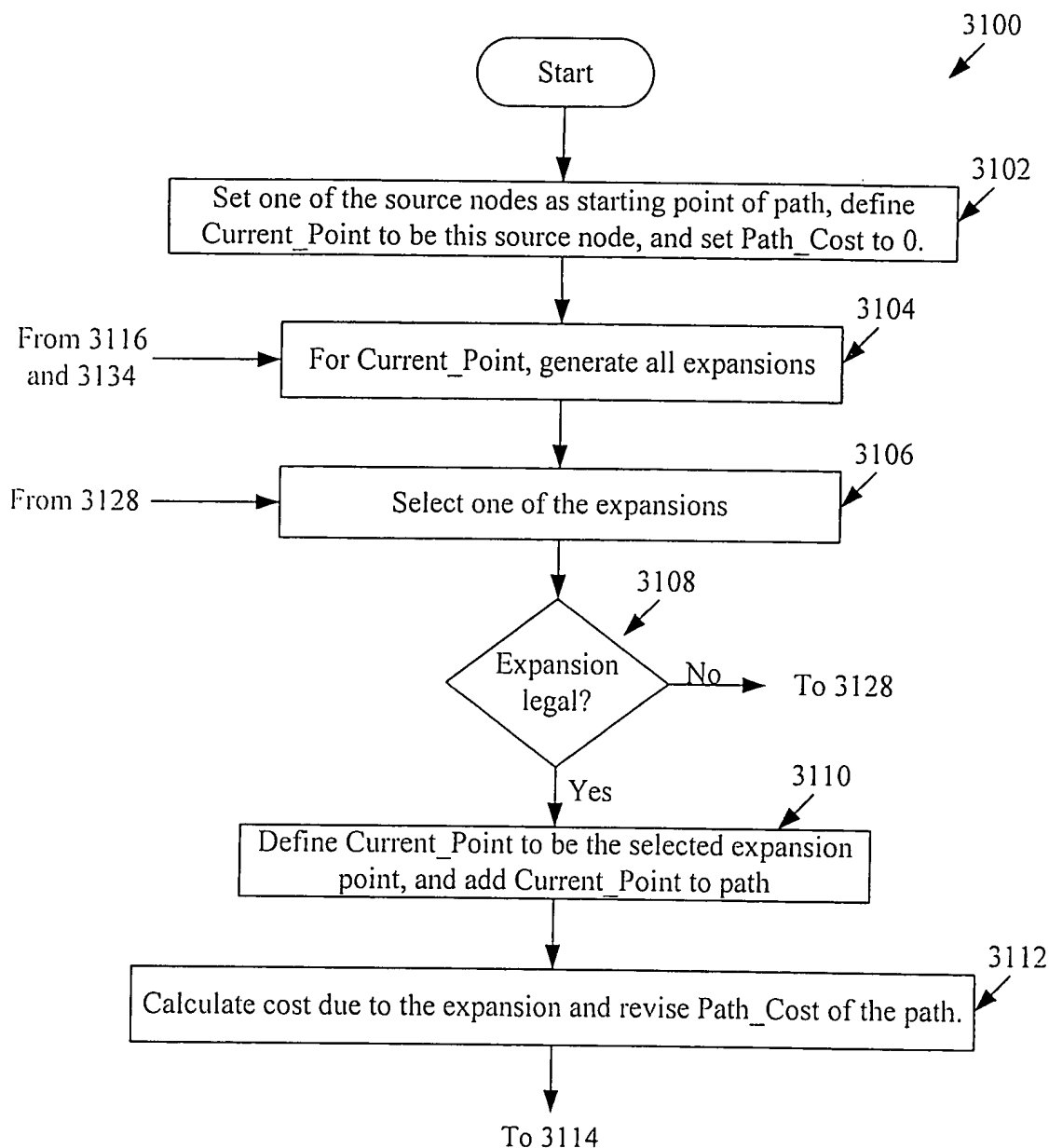
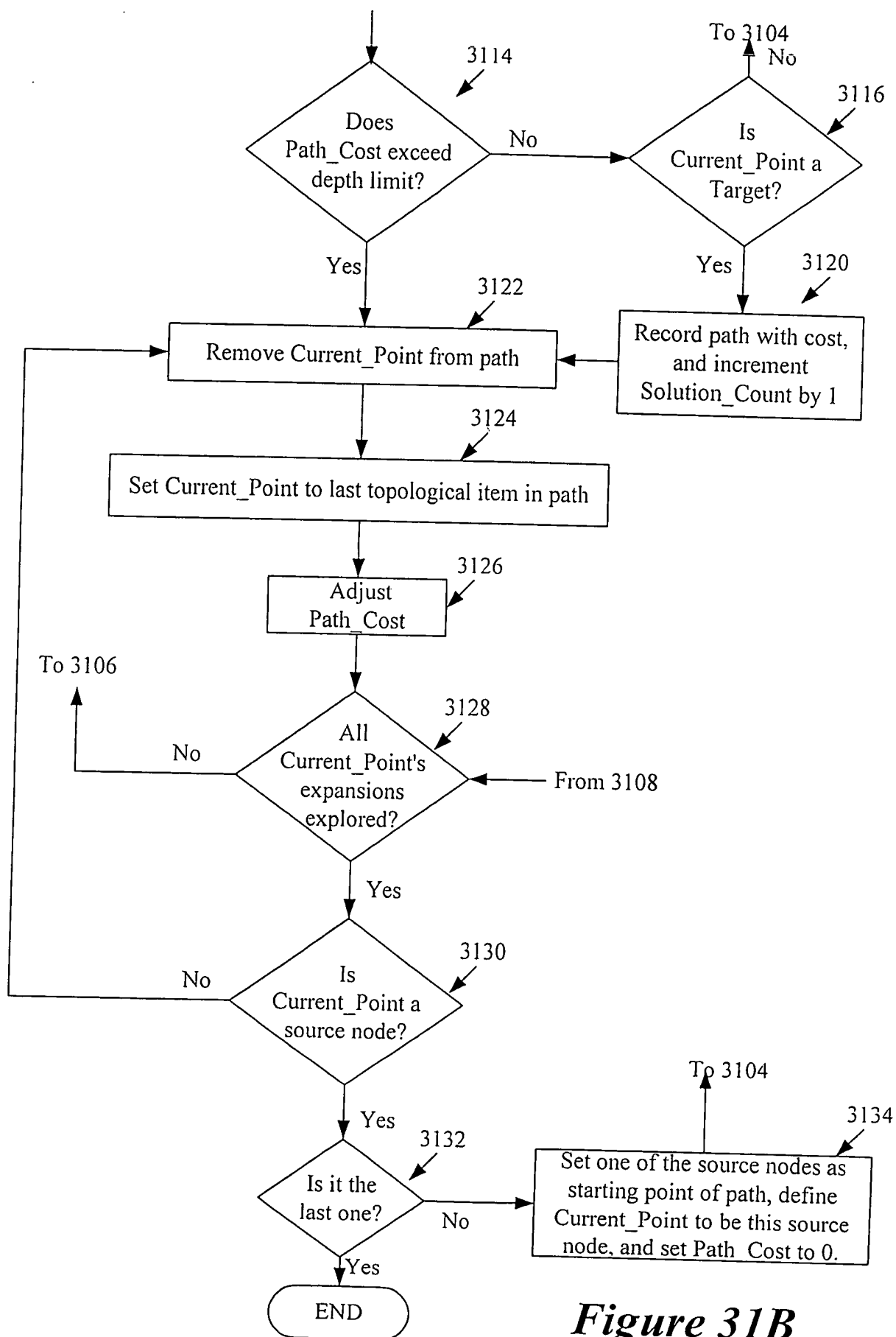


Figure 34



*Figure 31A*

*Figure 31:*  $\frac{\text{Figure 31A}}{\text{Figure 31B}}$



**Figure 31B**

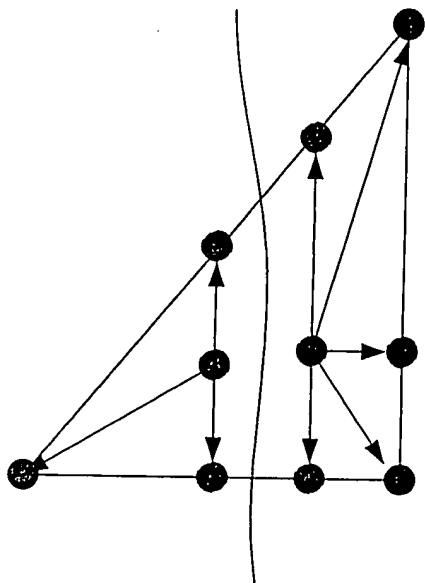


Figure 35

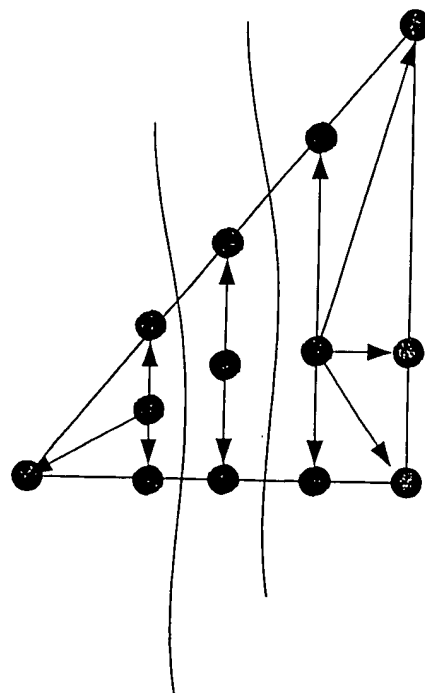


Figure 36

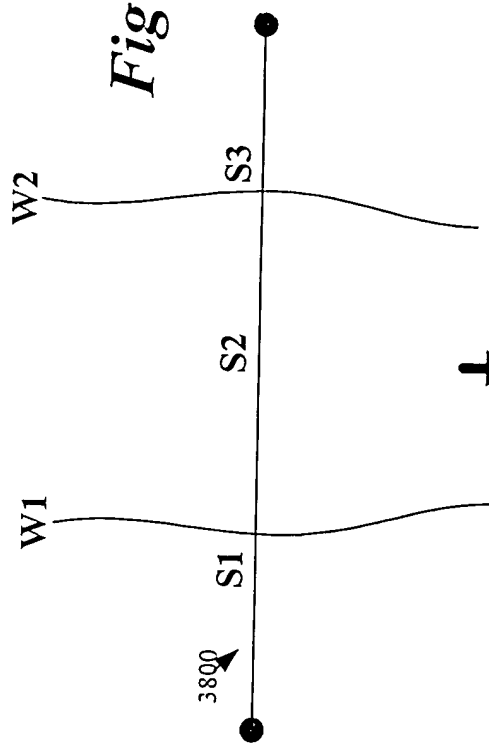


Figure 38A

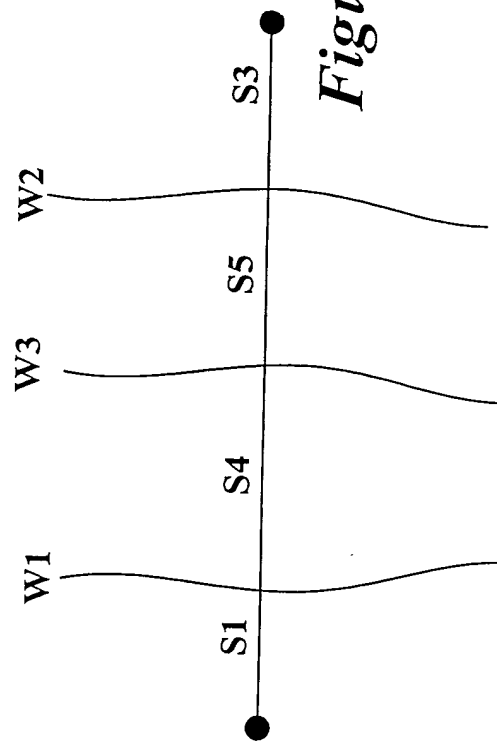
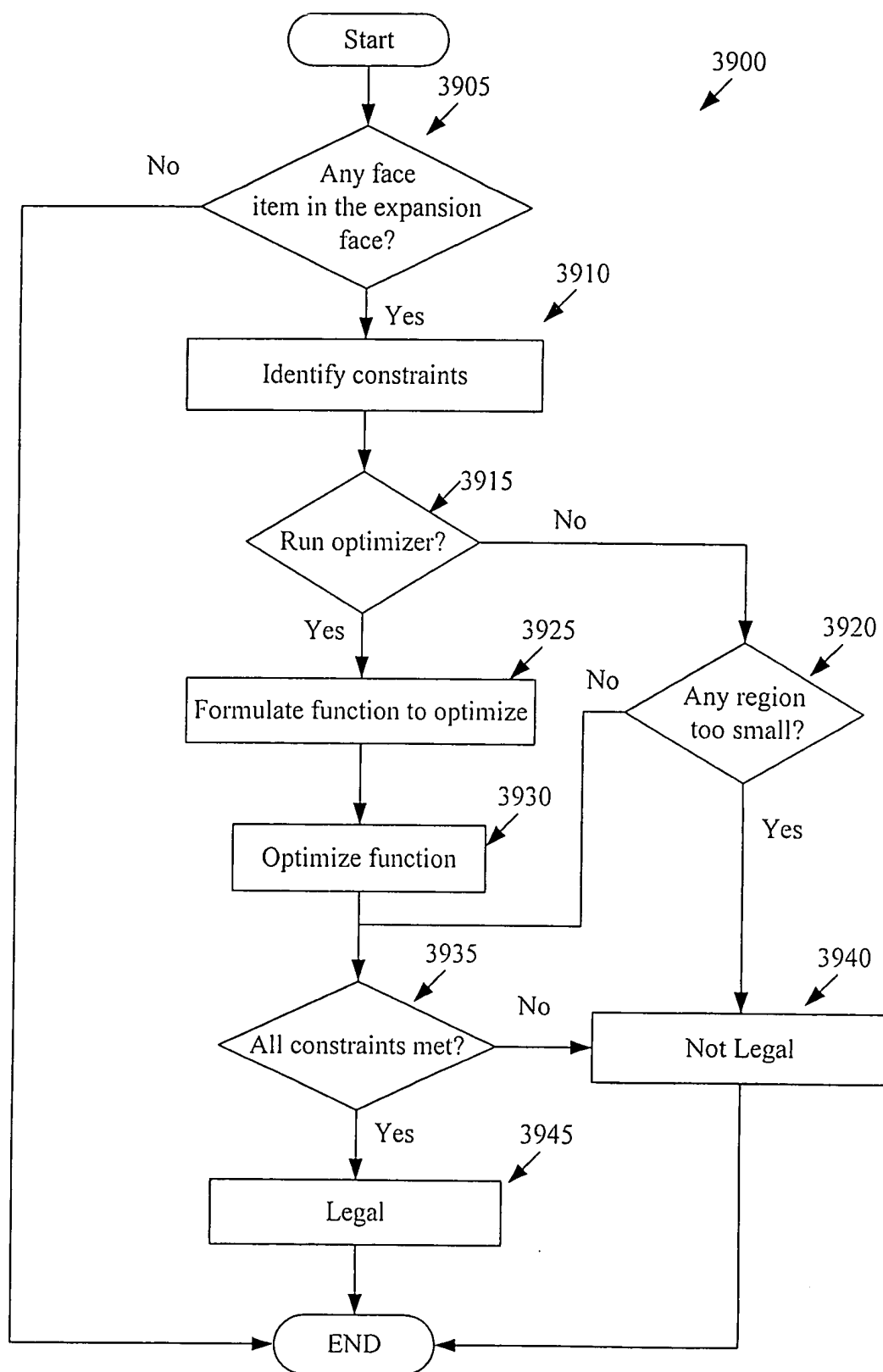


Figure 38B

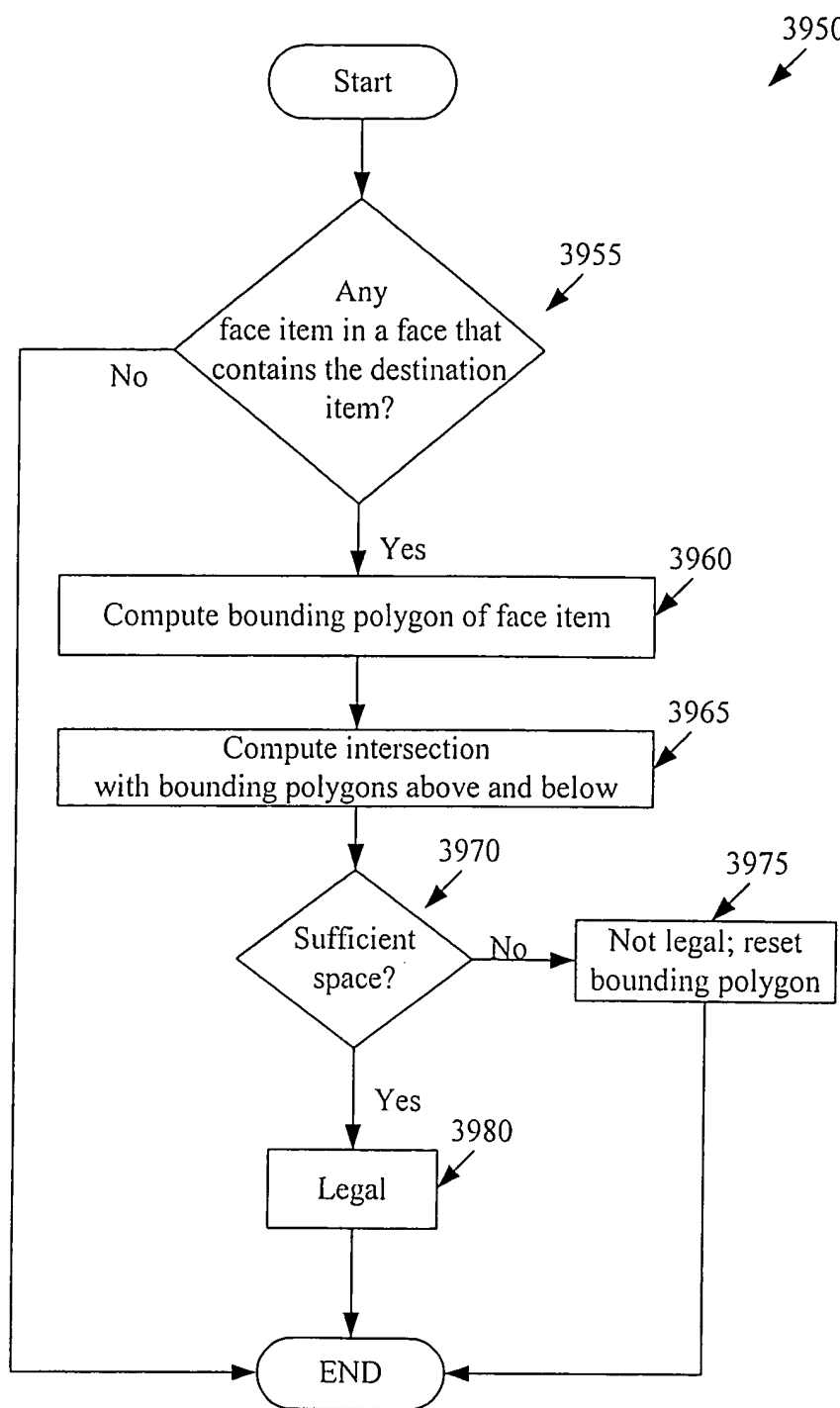
To:		Node	Face Item	Edge Item
From:	Node	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> <li>• Edge</li> <li>• Capacity</li> </ul>
	Face Item	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> <li>• Edge</li> <li>• Capacity</li> </ul>
	Edge Item	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> <li>• Edge</li> <li>• Capacity</li> </ul>

*Figure 37*

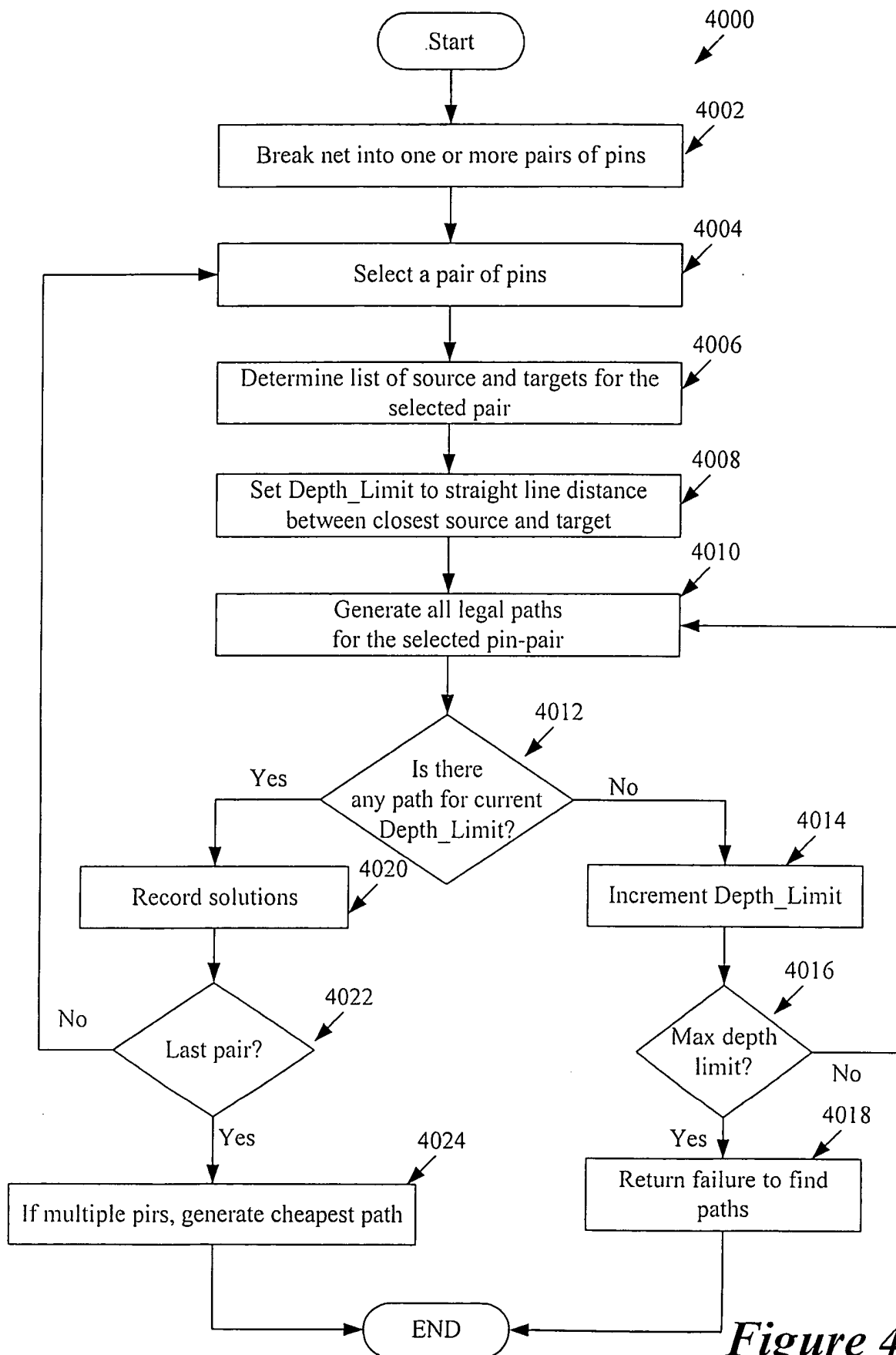


*Figure 39A*

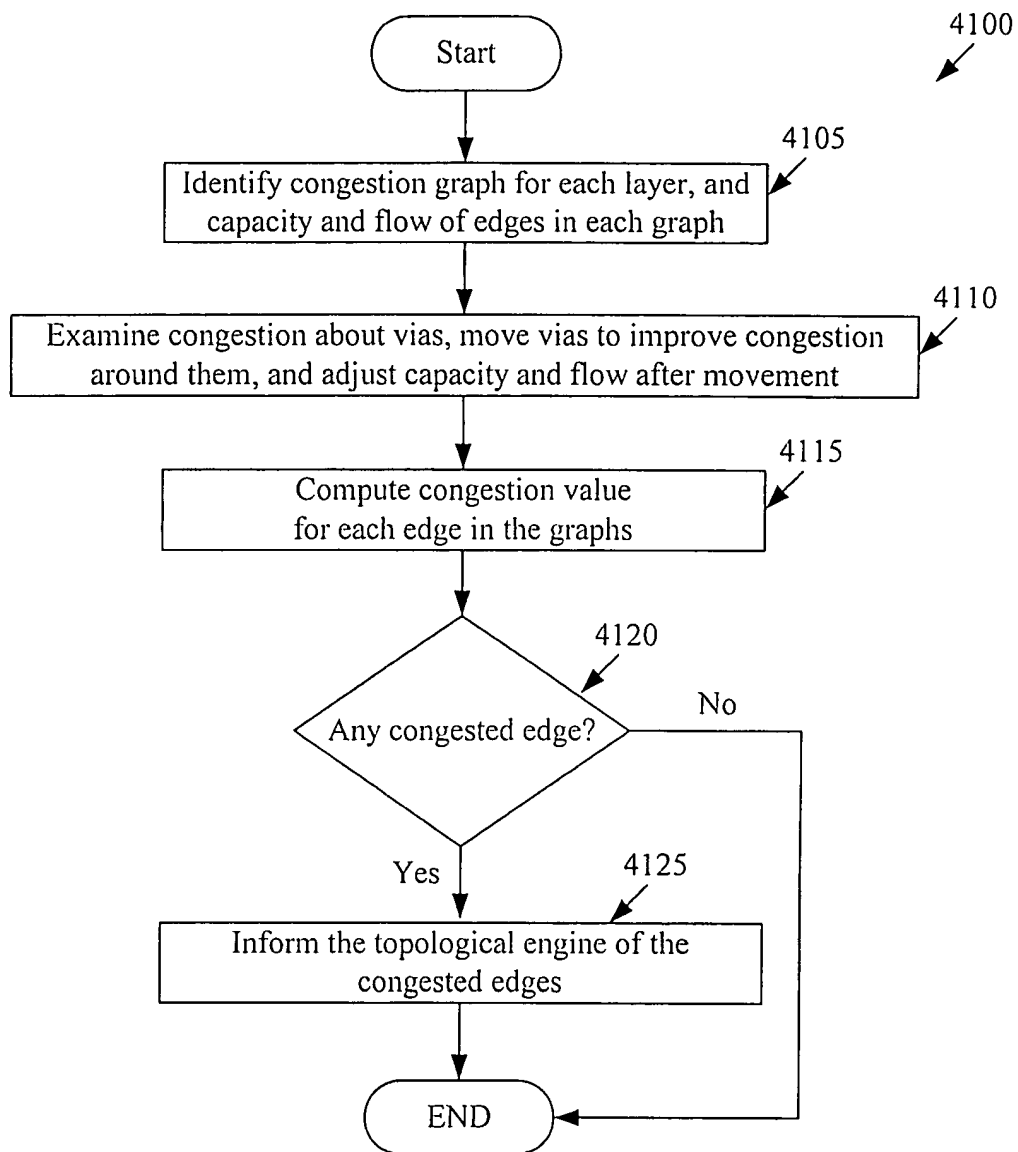
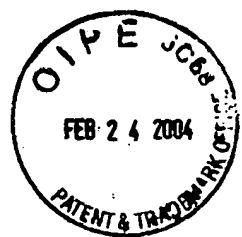




*Figure 39B*



*Figure 40*



*Figure 41*

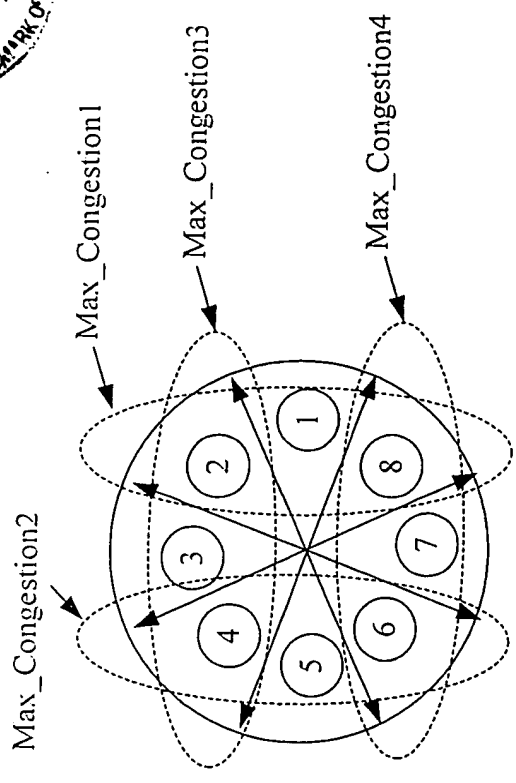


Figure 44

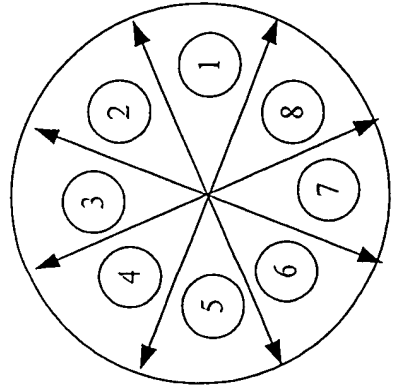


Figure 42

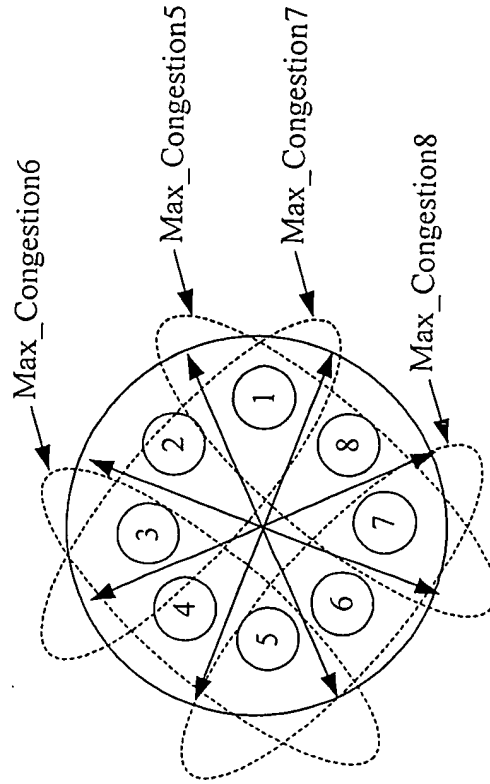


Figure 45

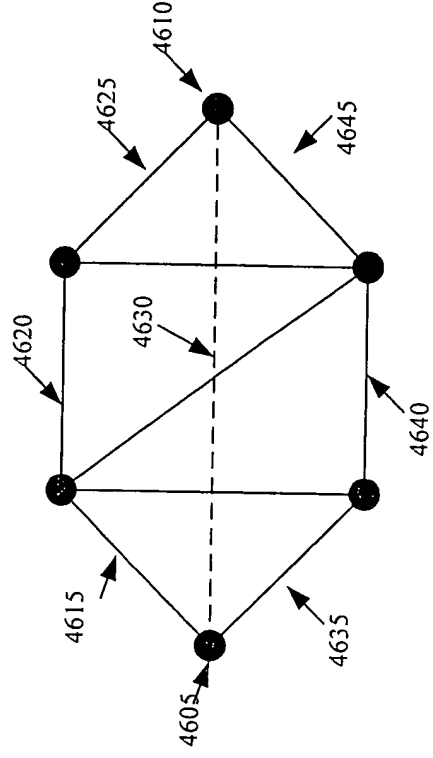
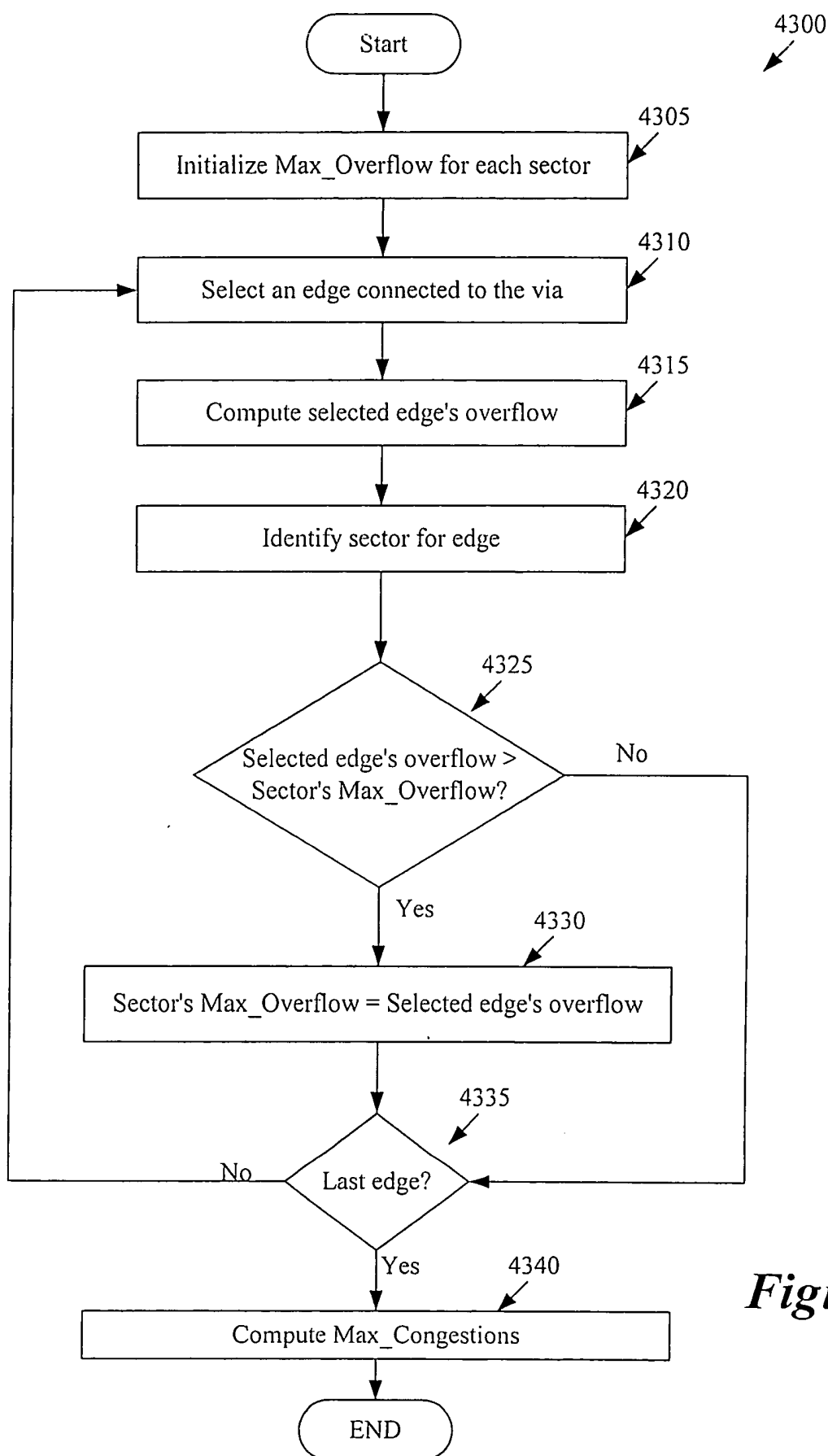
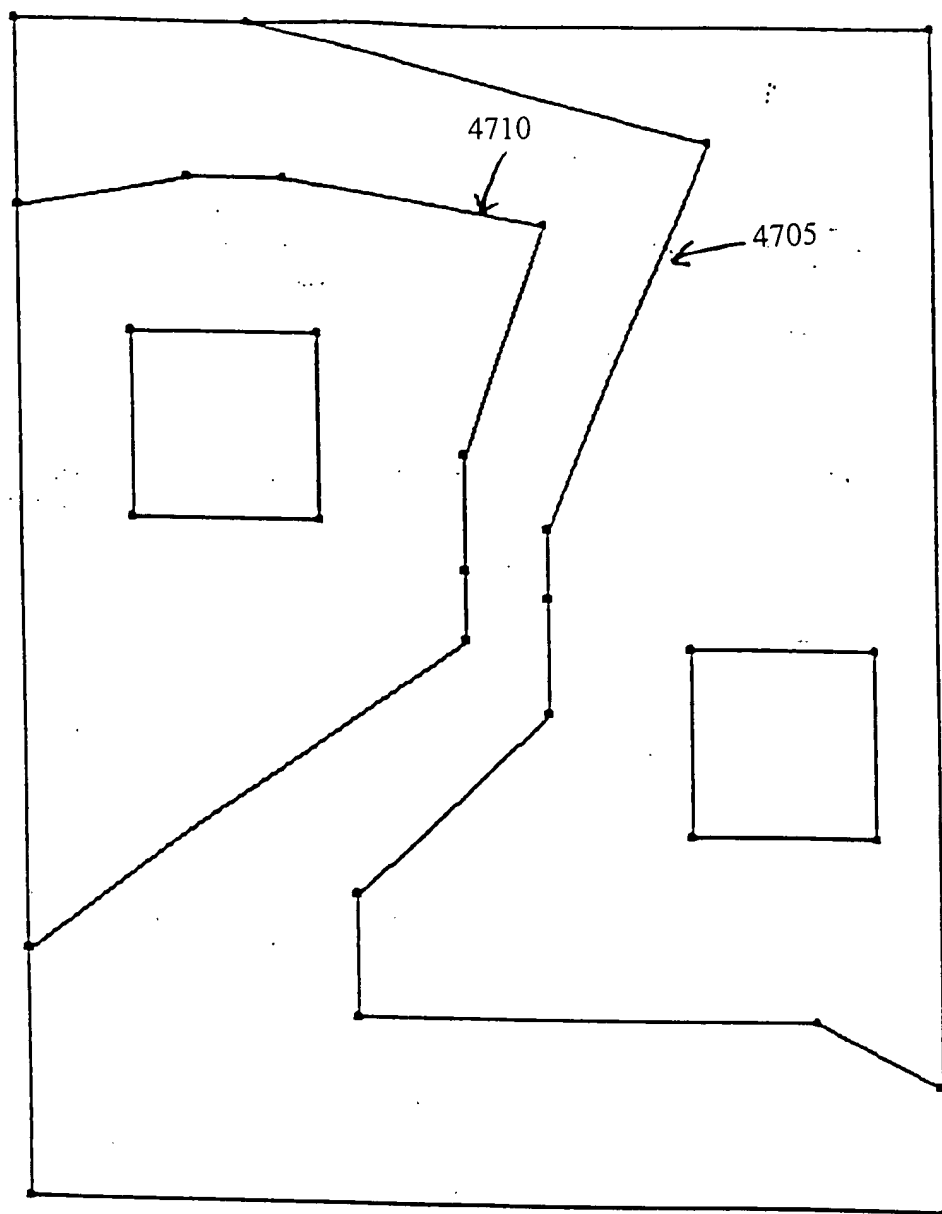


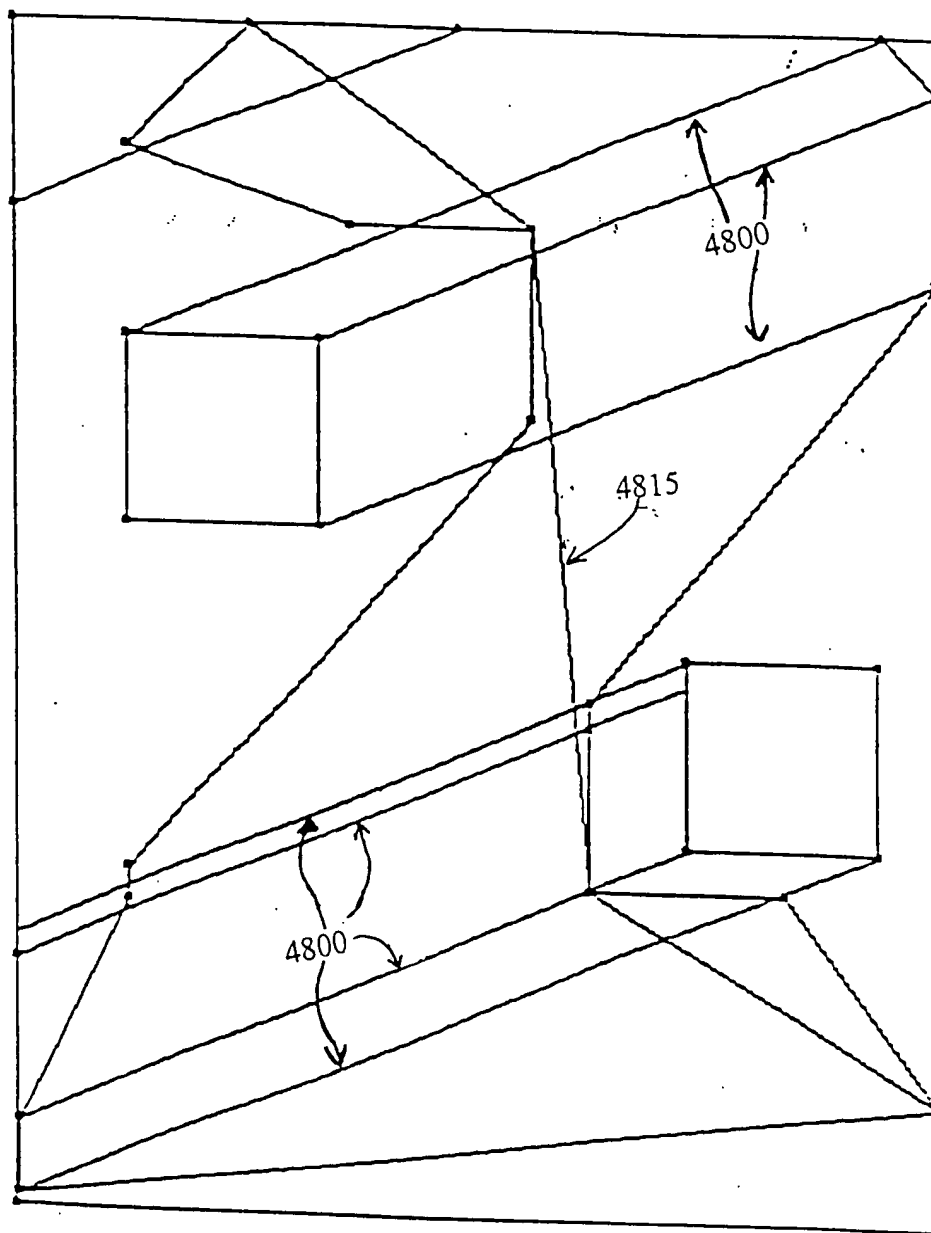
Figure 46



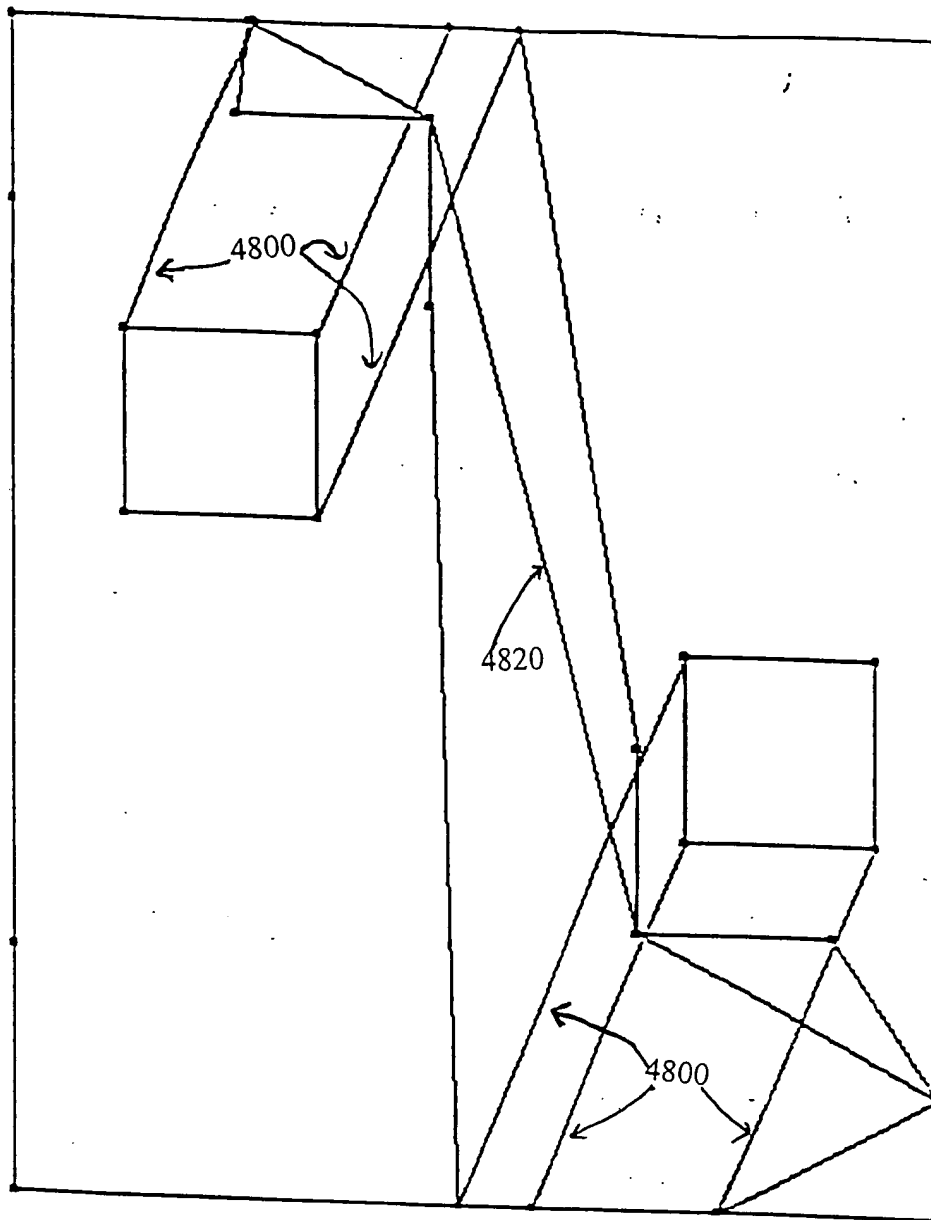
*Figure 43*



**FIGURE 47**

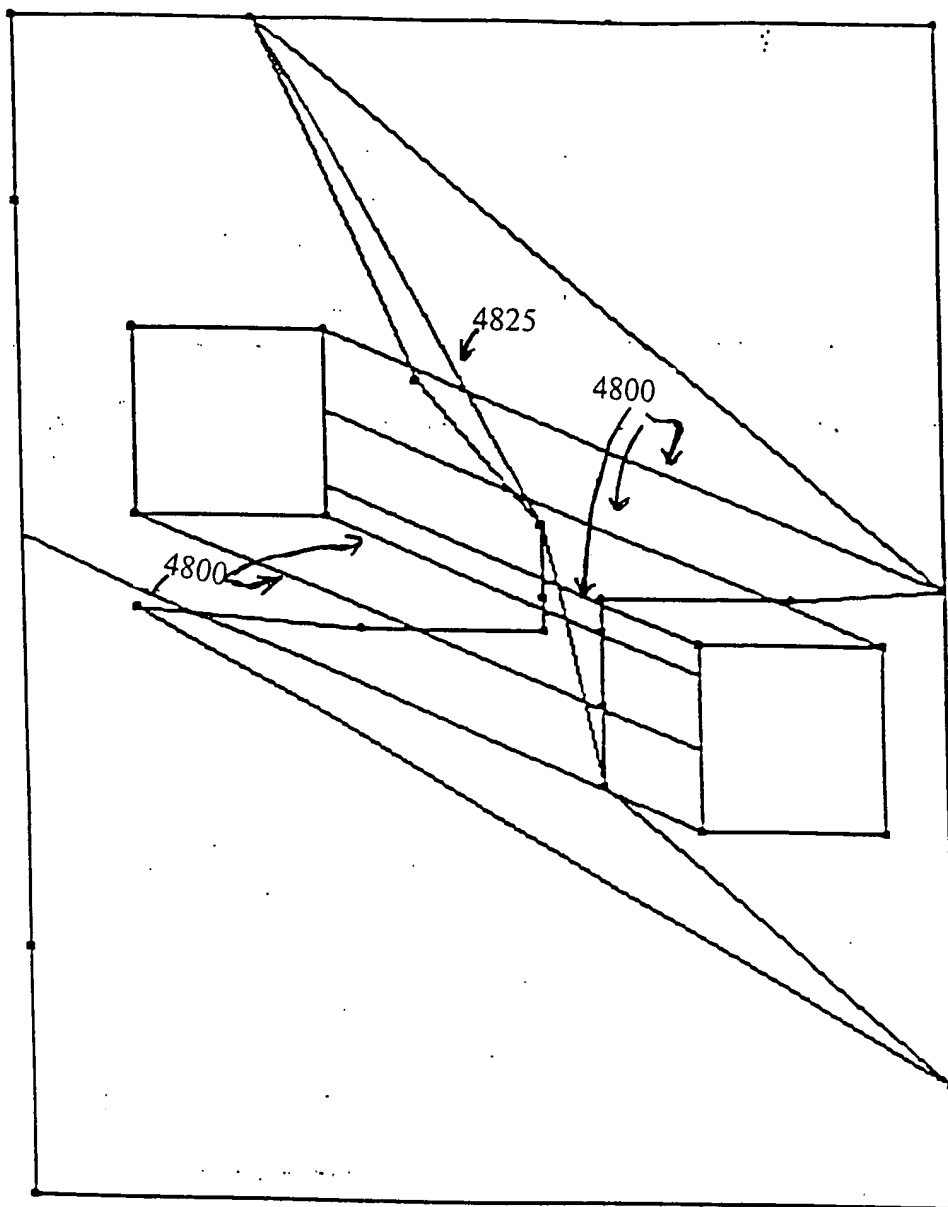


**FIGURE 48A**

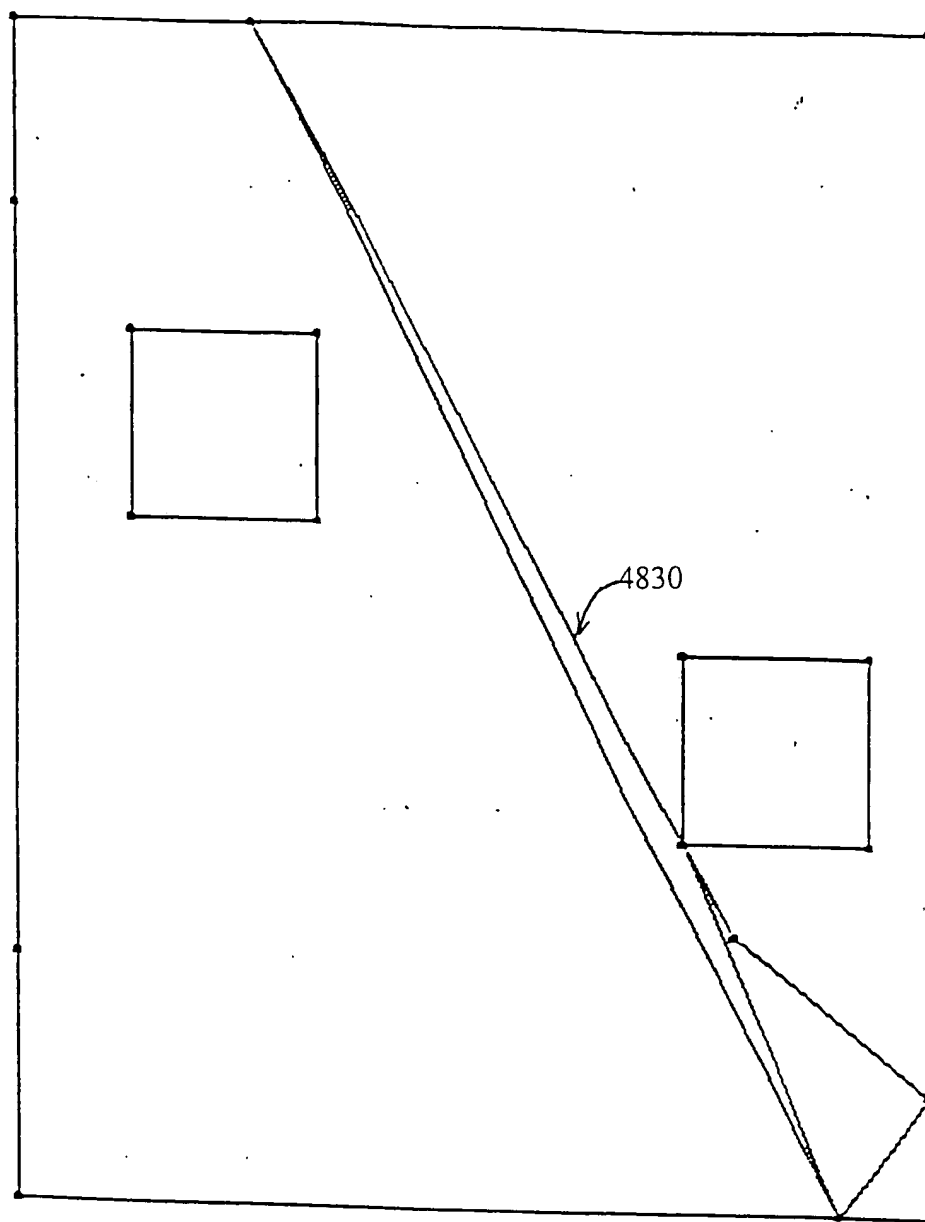
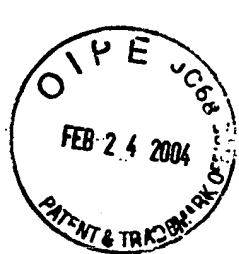


**FIGURE 48B**

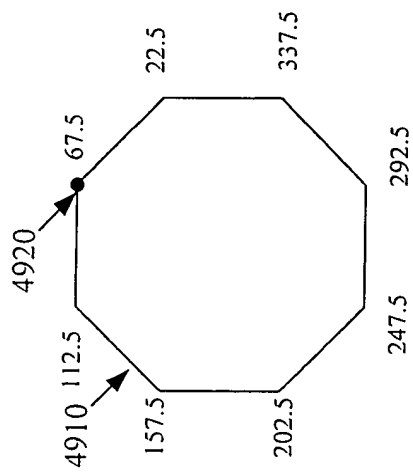




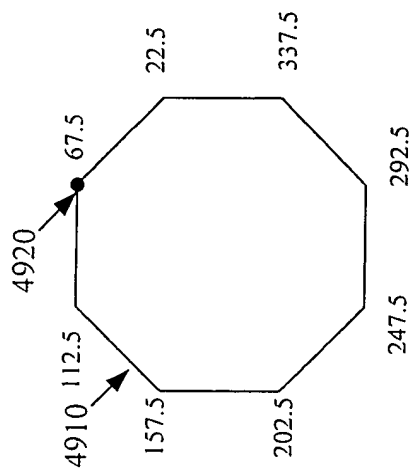
**FIGURE 48C**



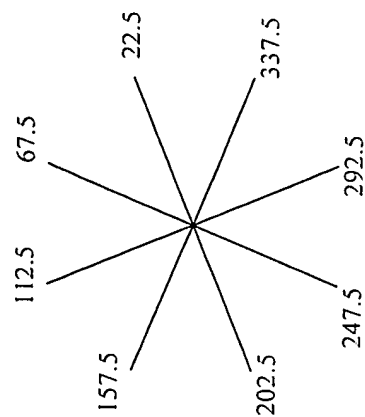
*FIGURE 48D*



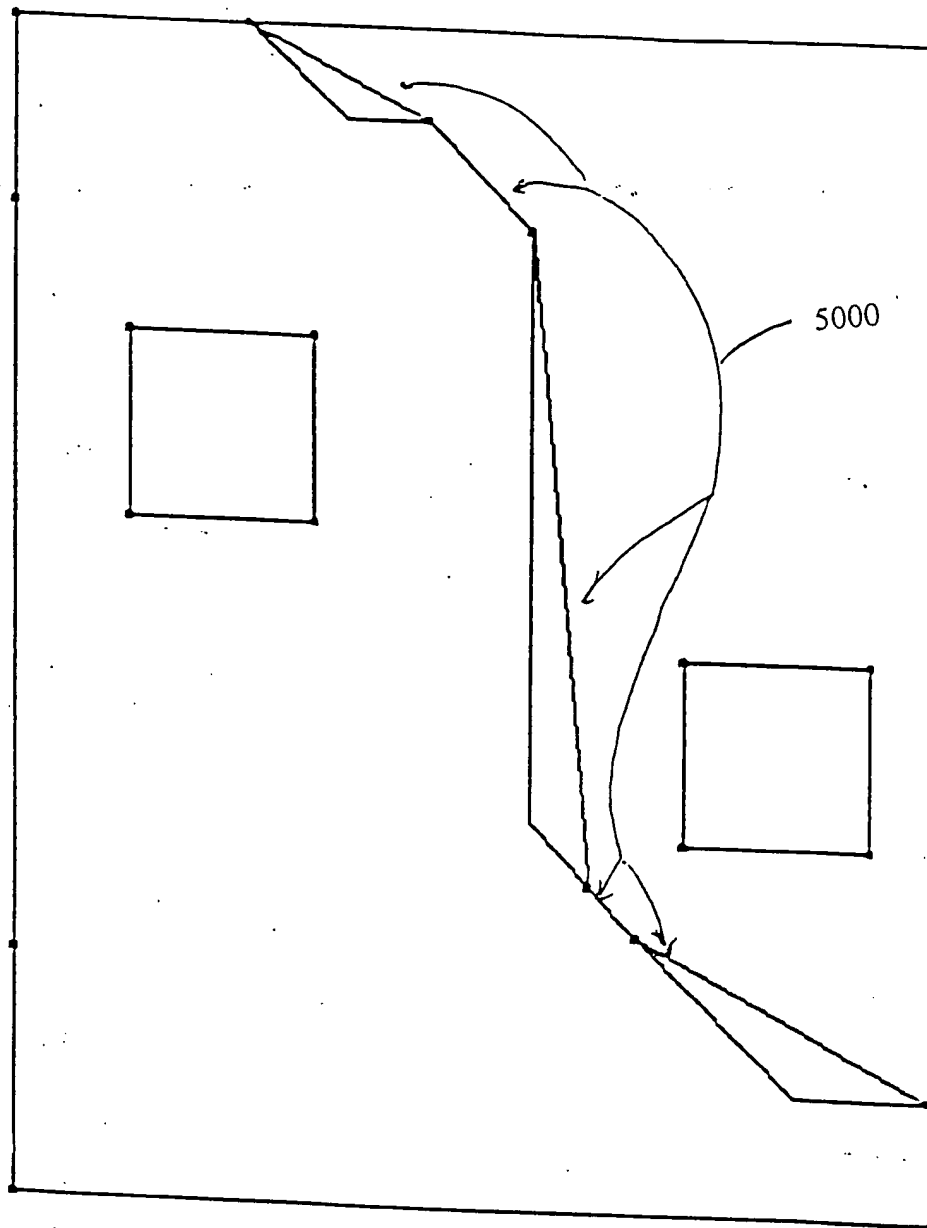
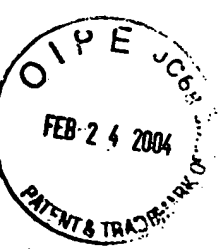
*Figure 49A*



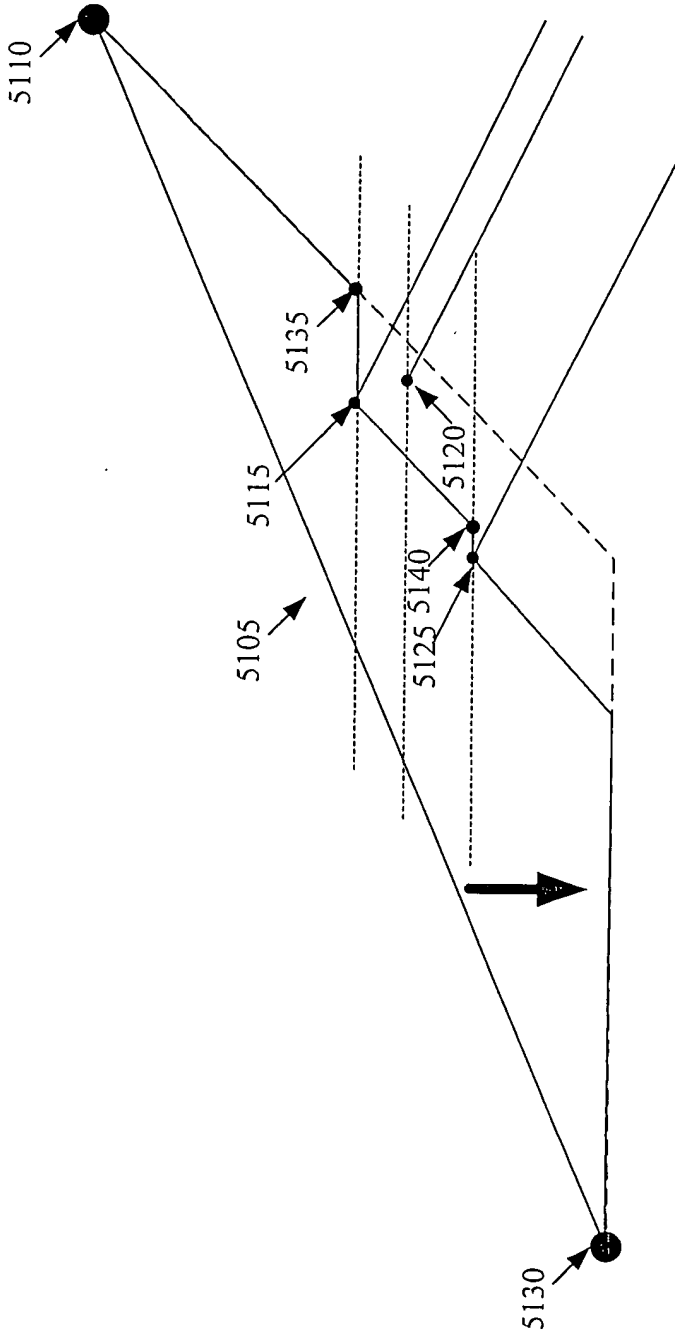
*Figure 49B*



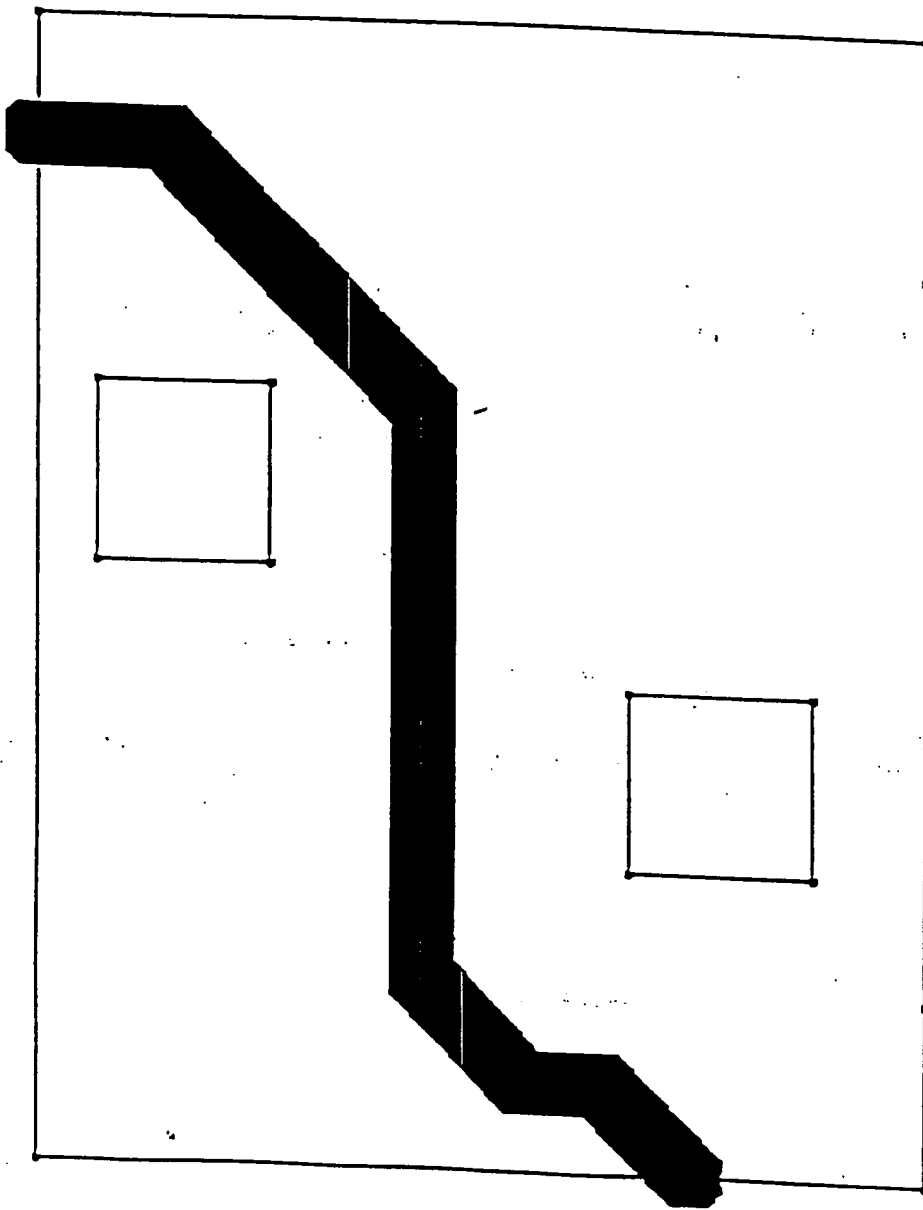
*Figure 49C*



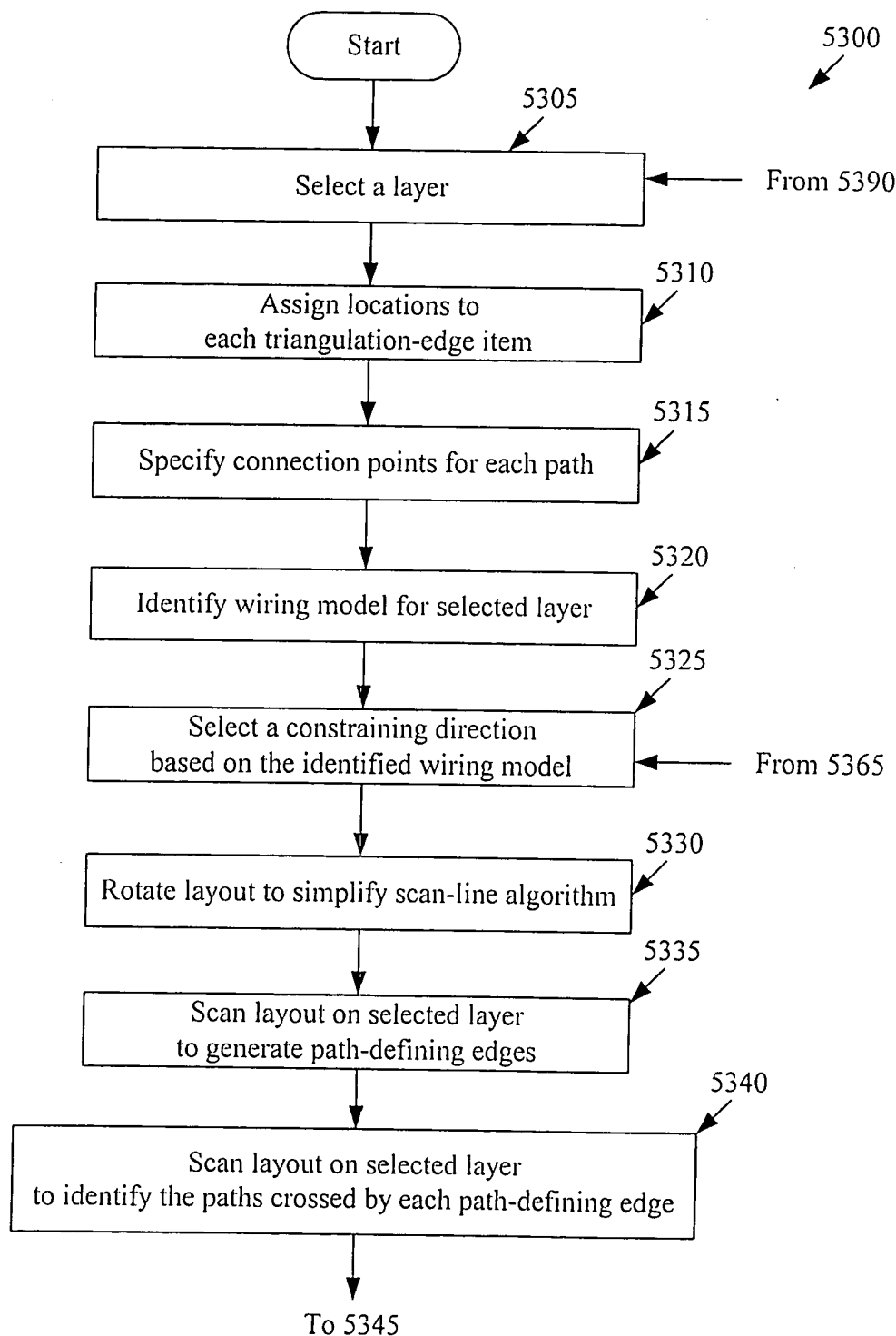
**FIGURE 50**



*Figure 51*

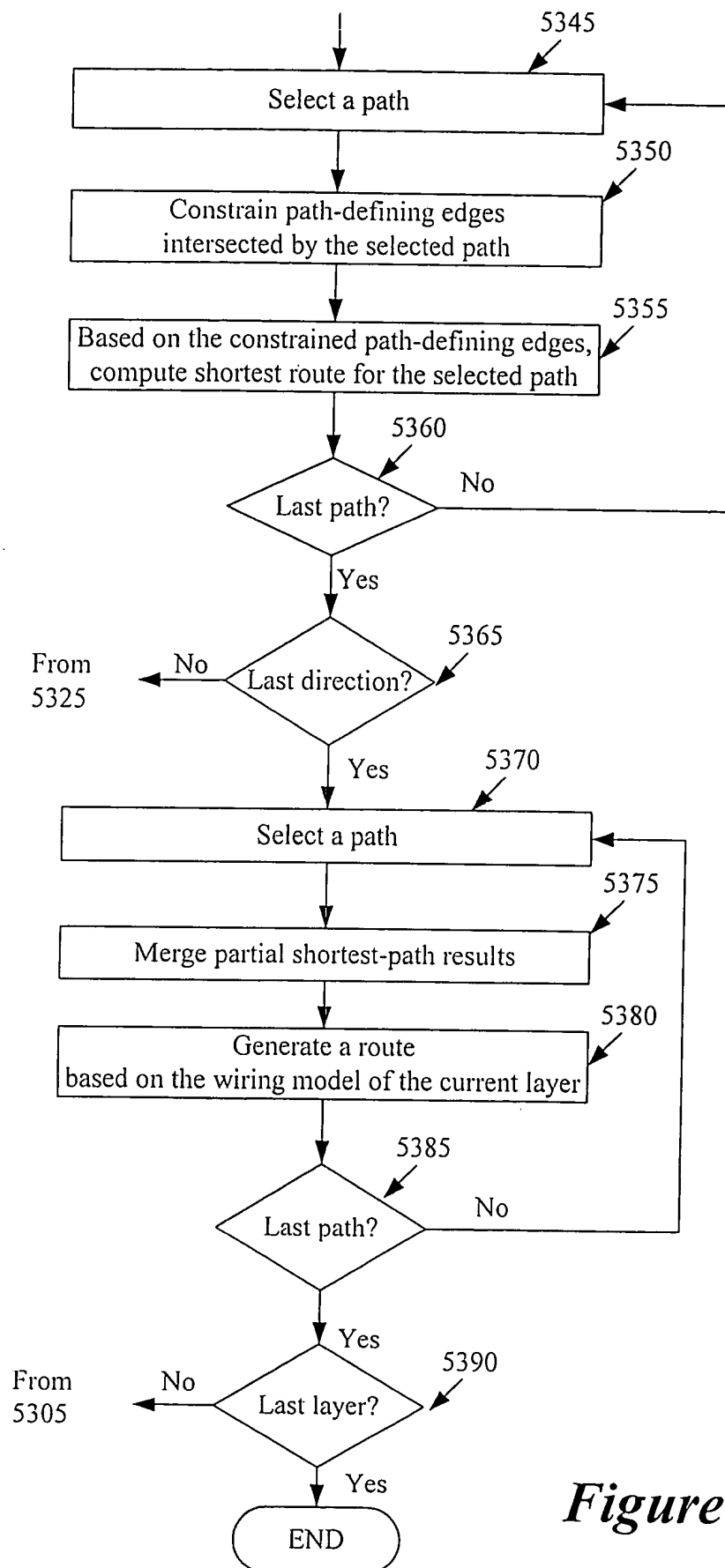


**FIGURE 52**



**Figure 53**

**Figure 53:** *Figure 53A*  
*Figure 53B*



*Figure 53B*



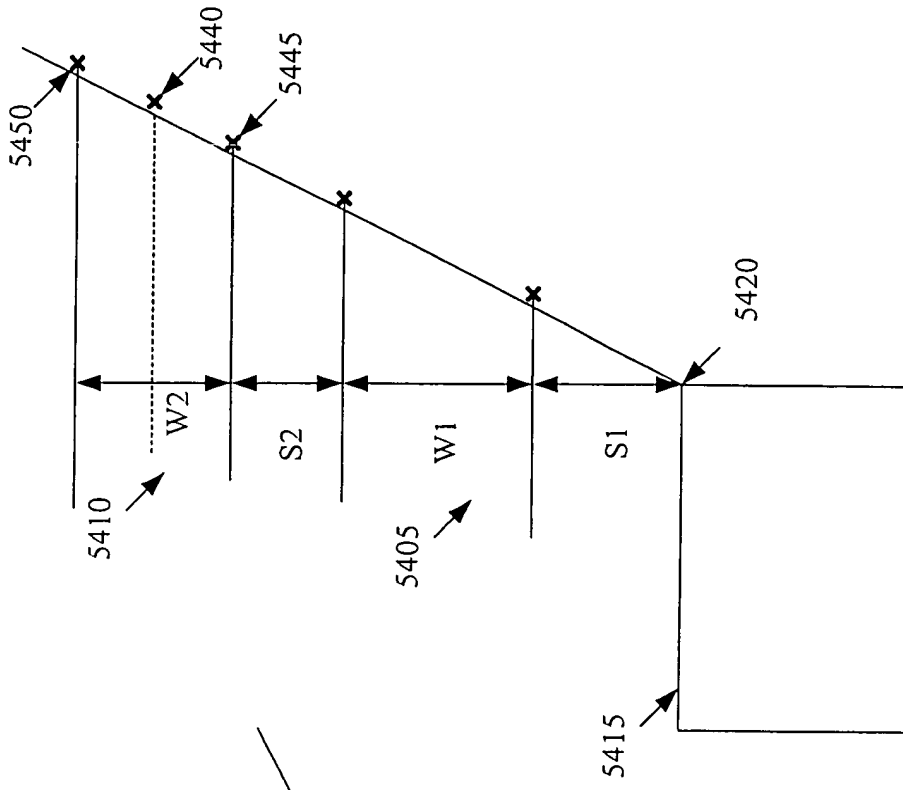


Figure 55

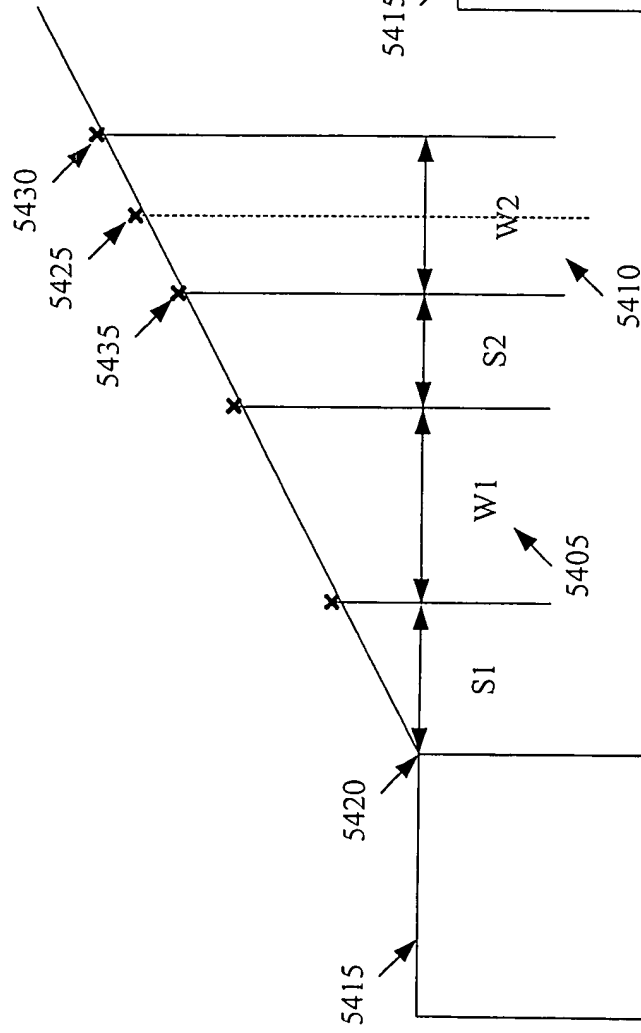


Figure 54

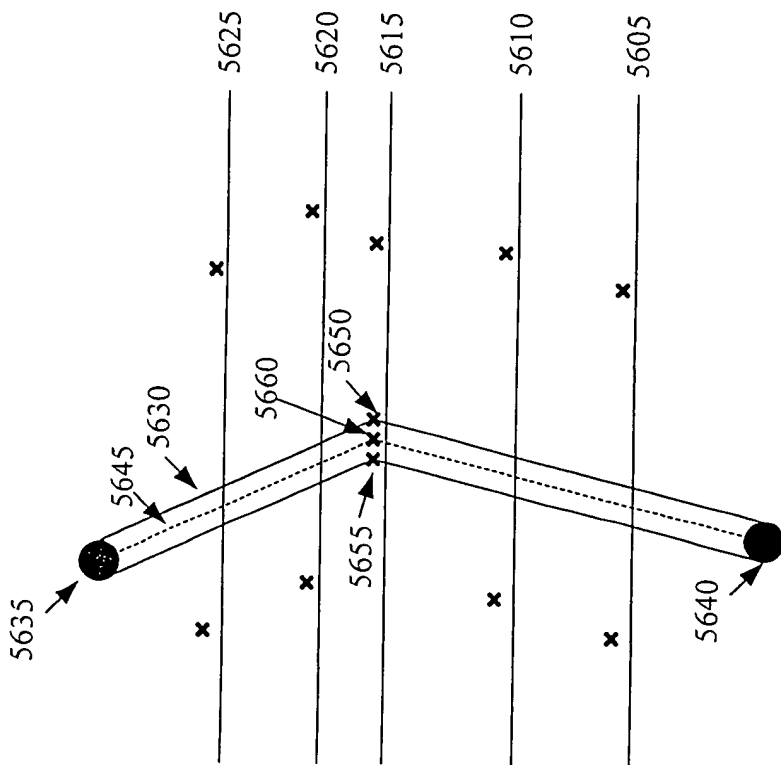


Figure 56

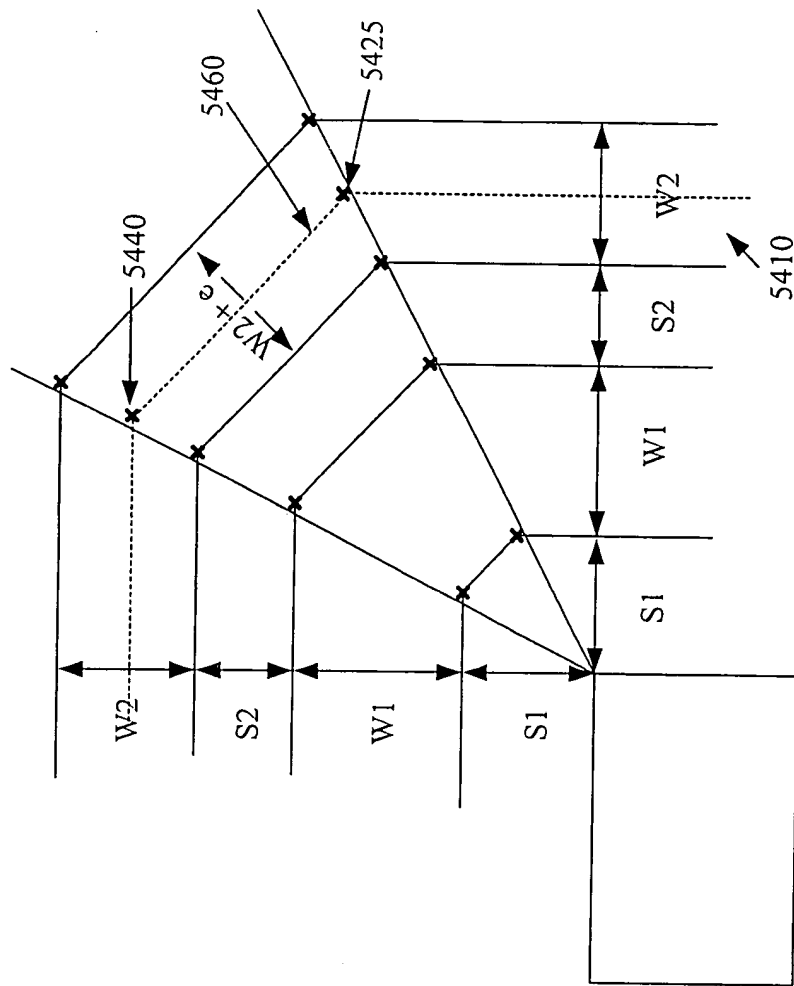
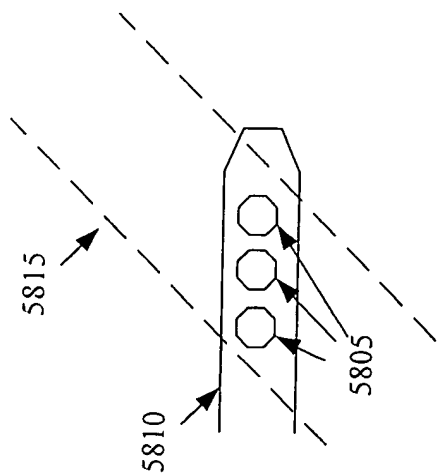
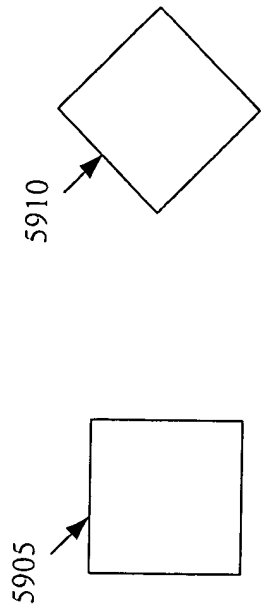


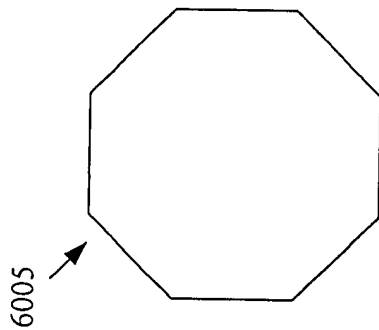
Figure 57



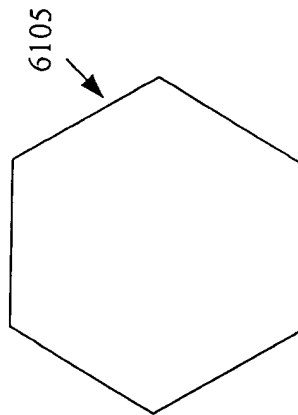
*Figure 58*



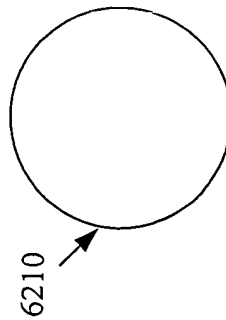
*Figure 59*



*Figure 60*



*Figure 61*



*Figure 62*

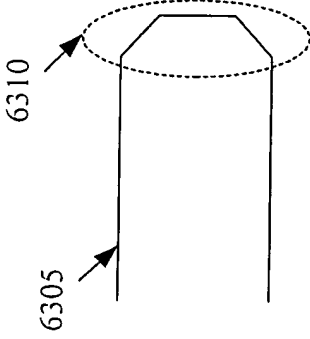


Figure 63

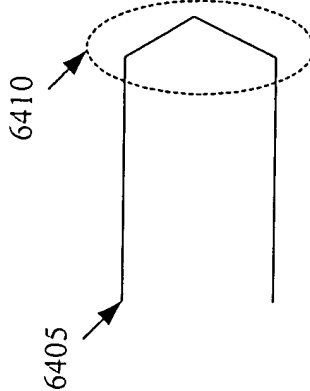


Figure 64

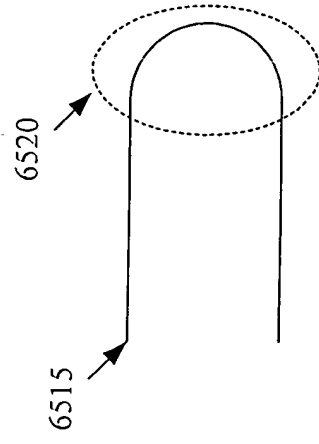
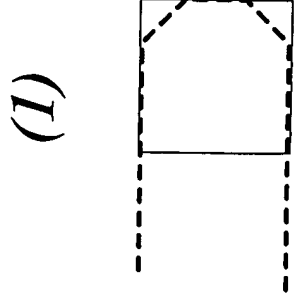
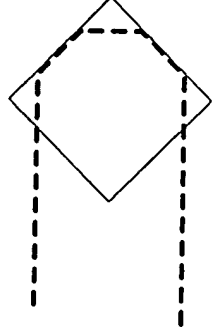


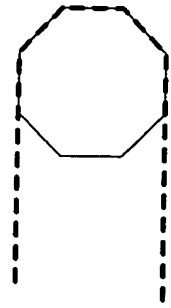
Figure 65



(1)



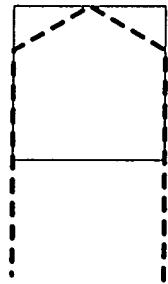
(2)



(3)

Figure 66

(1)



(2)

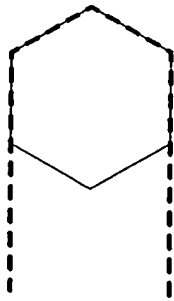


Figure 67

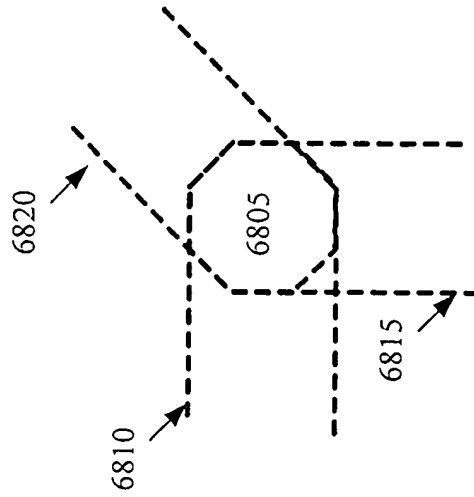


Figure 68

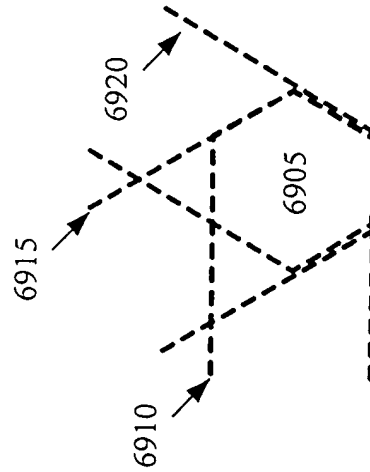


Figure 69

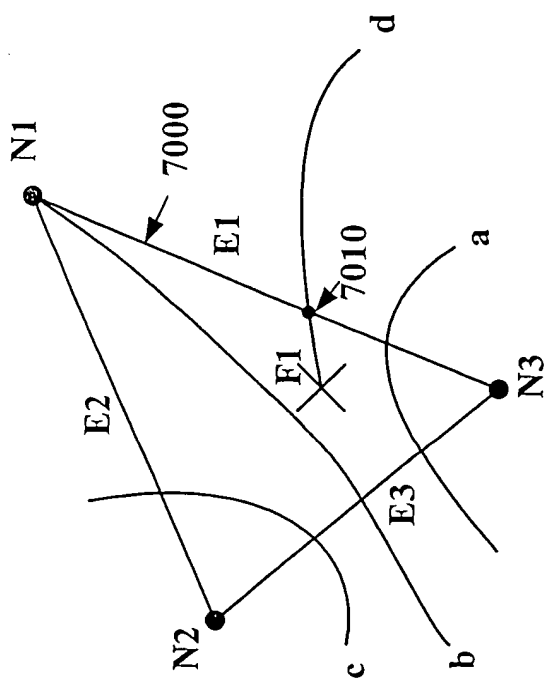


Figure 70

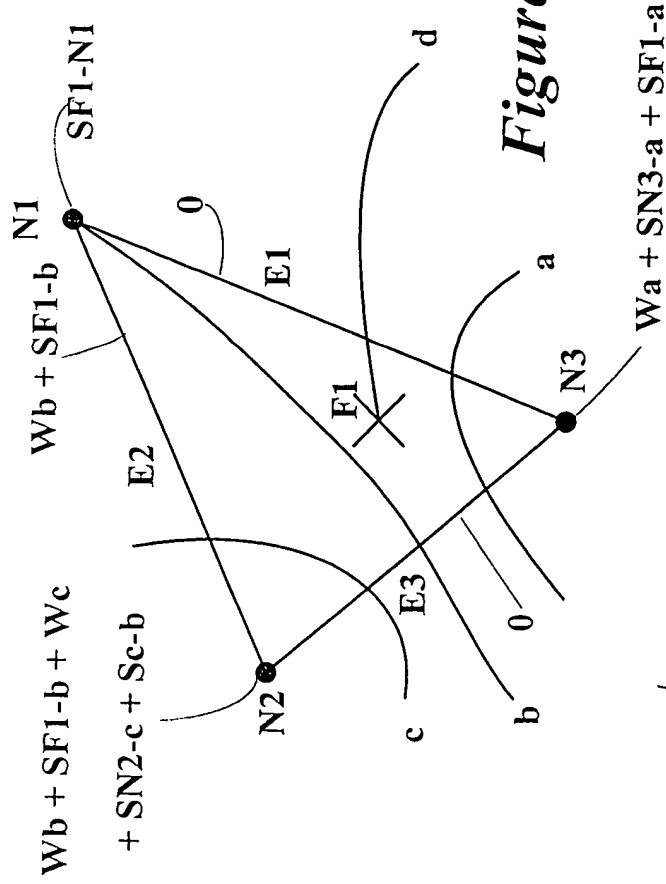


Figure 71

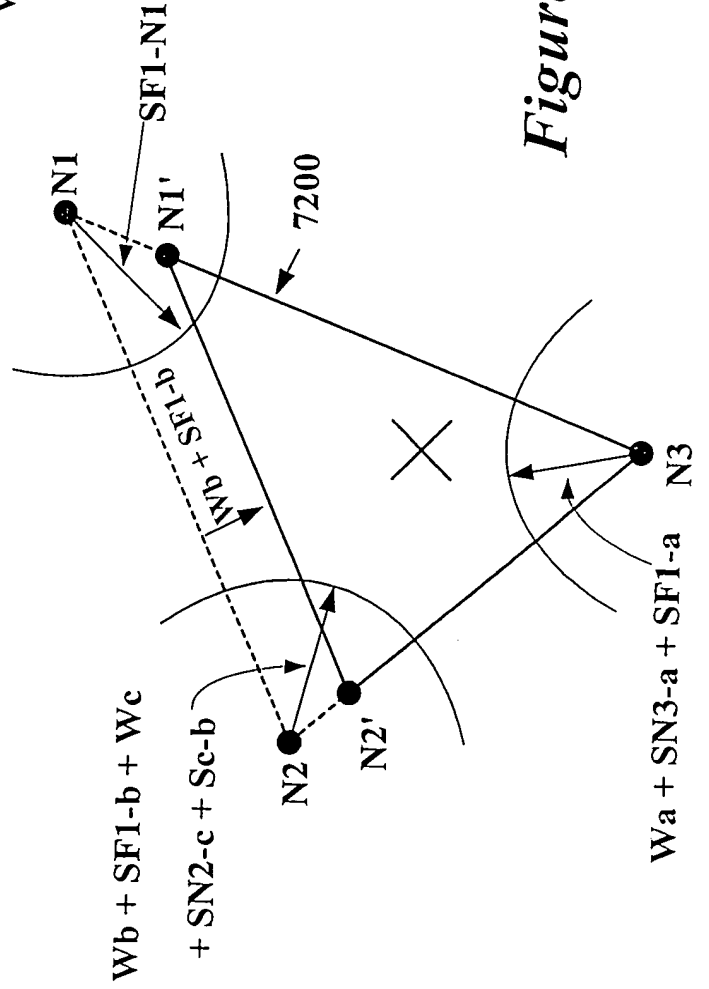


Figure 72



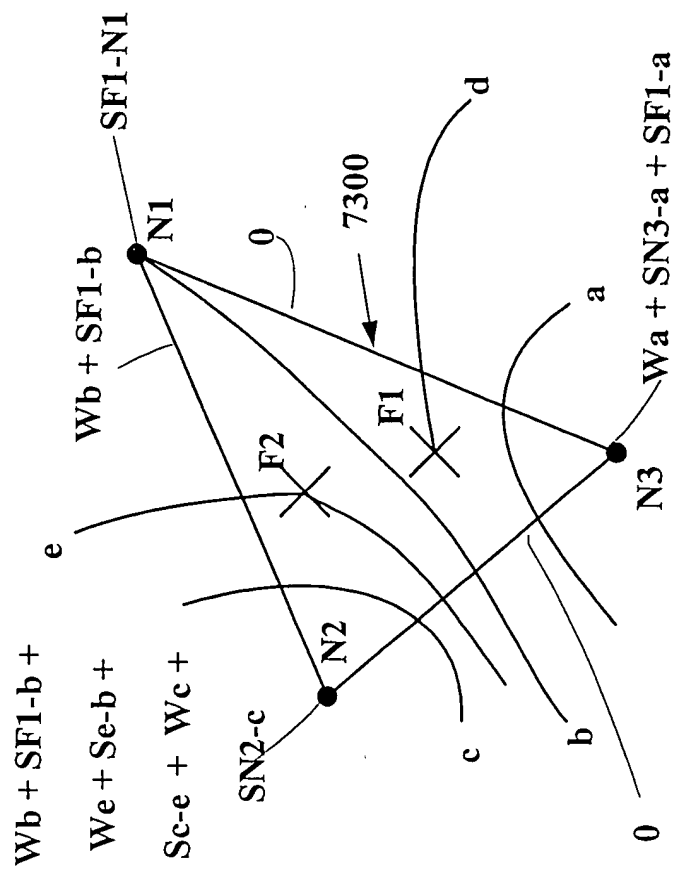


Figure 76

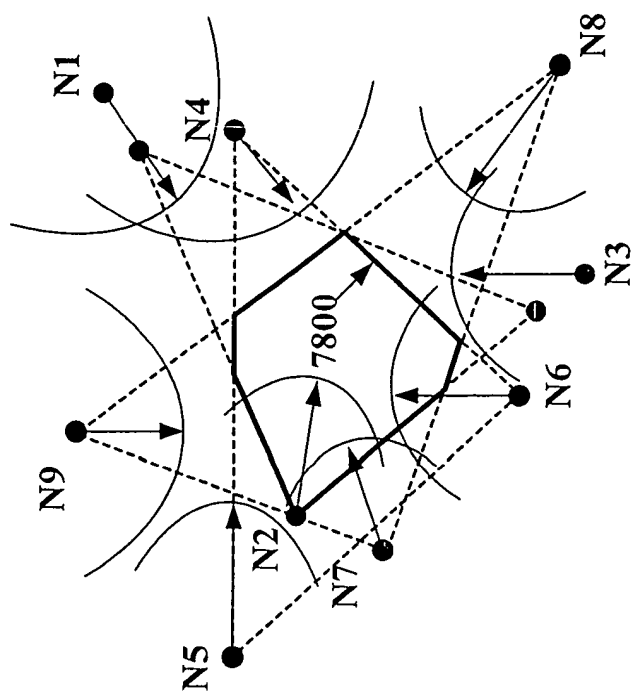
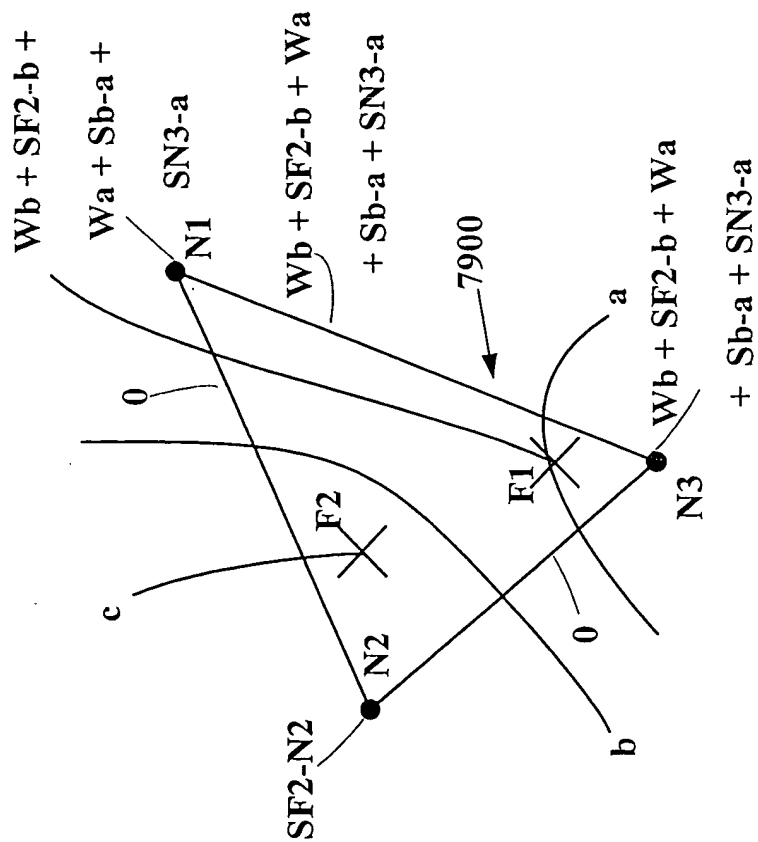
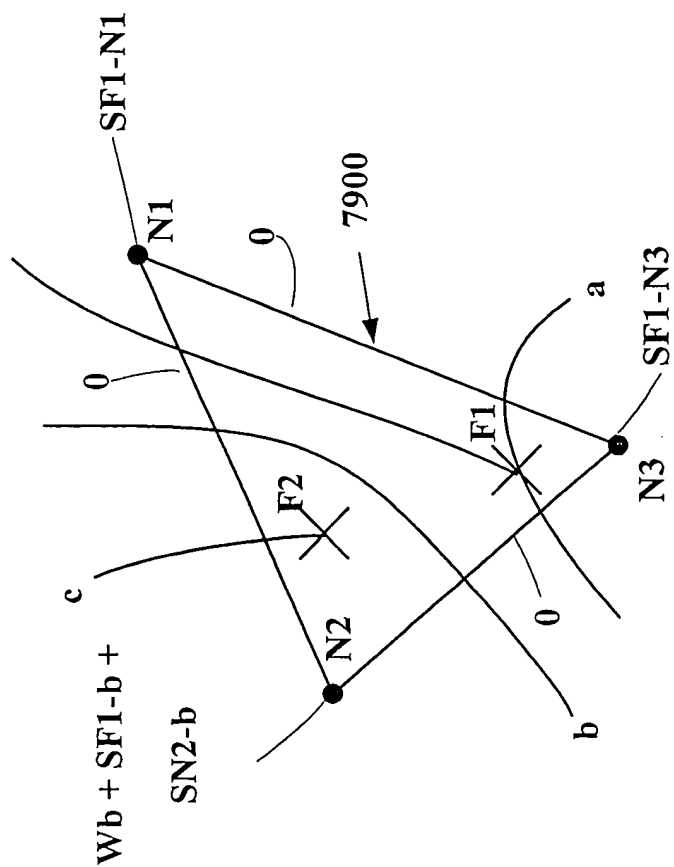


Figure 78





*Figure 80*



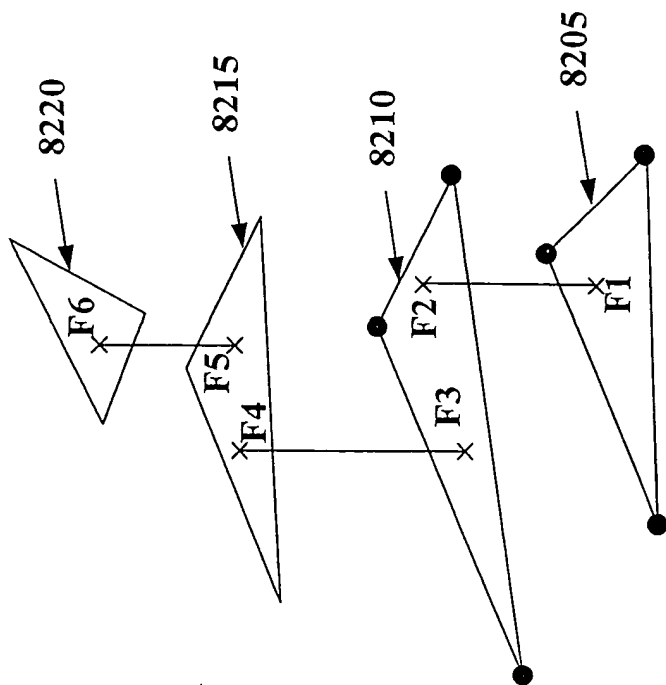


Figure 81

Figure 82



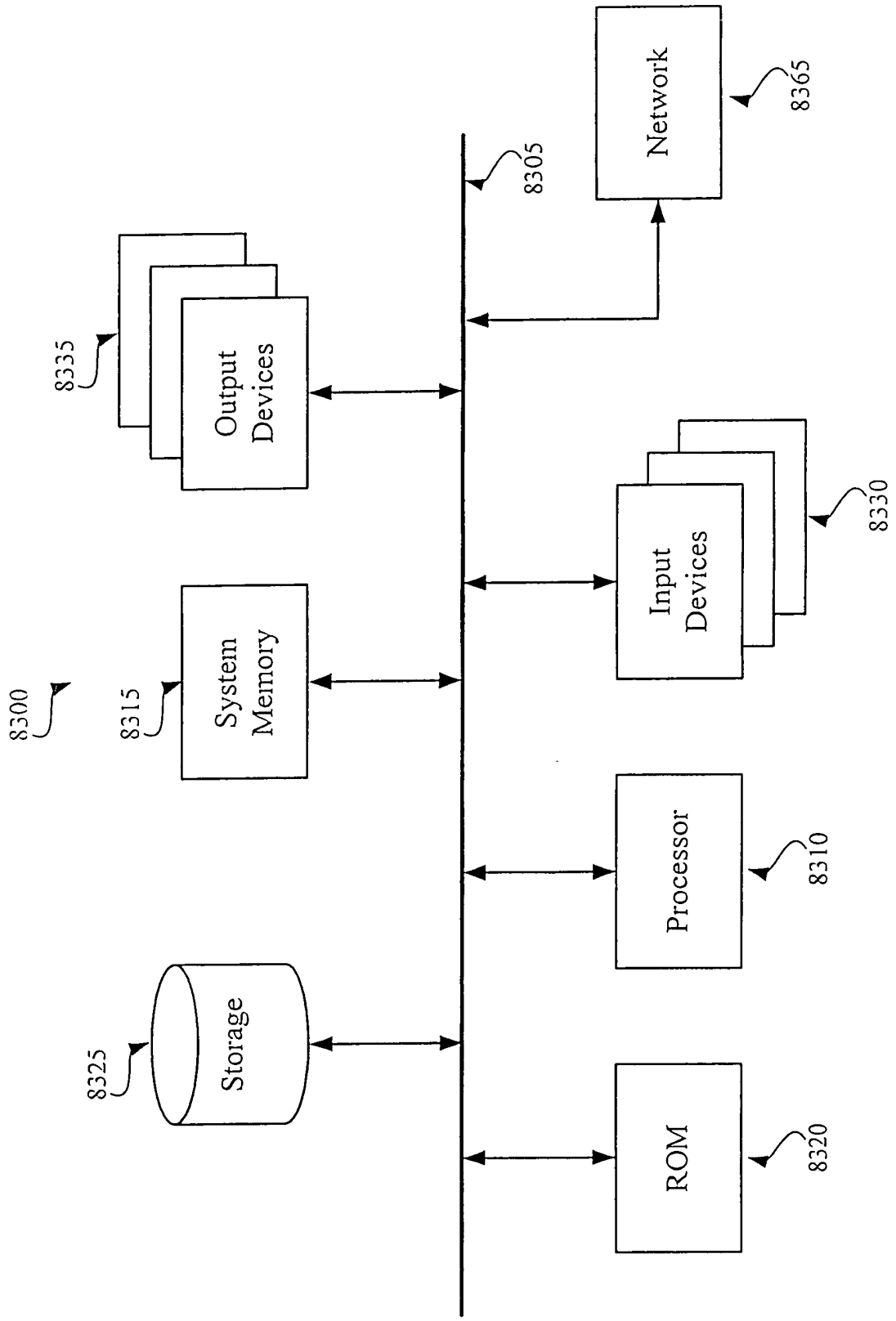
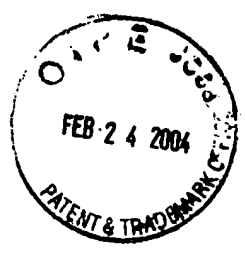


Figure 83